THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CXII. No. 2473.] LONDON, OCTOBER 4, 1910. [62ND YEAR. PRICE 6d.

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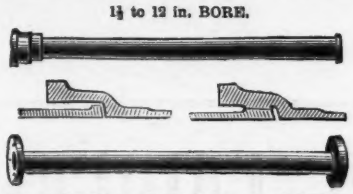

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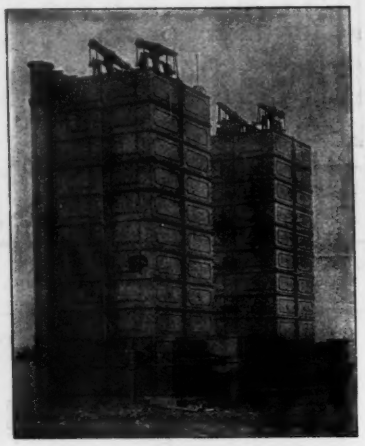

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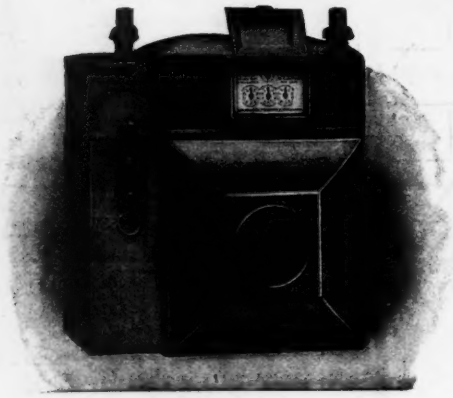

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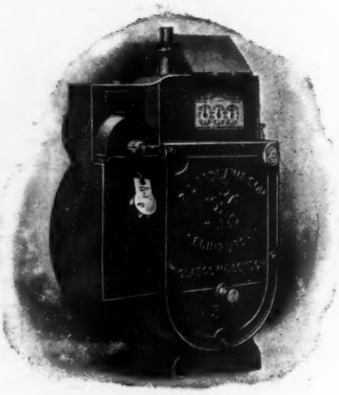

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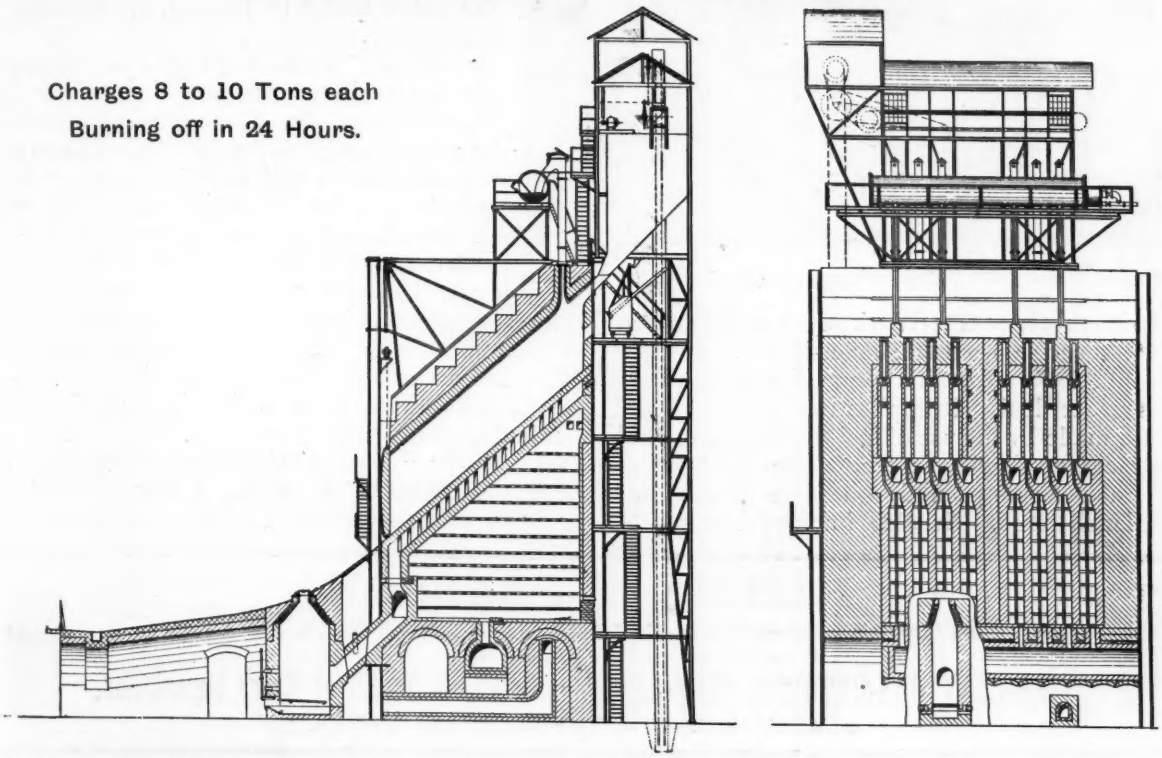

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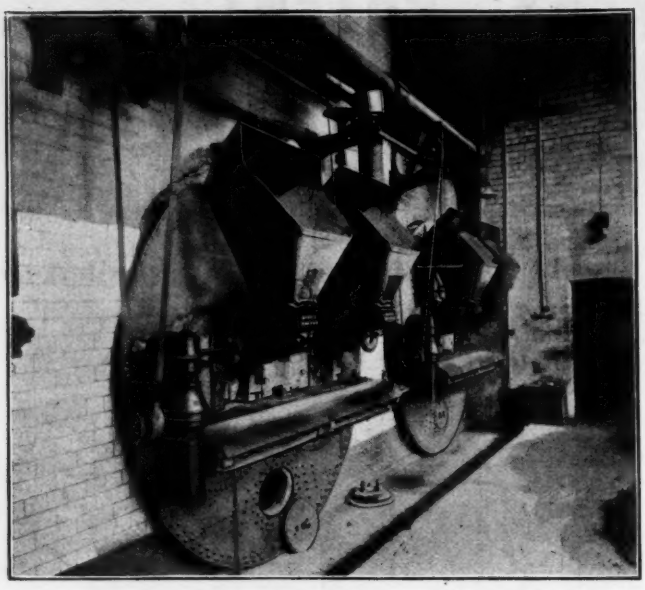

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It is not every Gas-Works even at this time of day that runs a profitable boiler-house. The word "profitable" used in this connection is significant of a great deal. It implies *Cheap Steam*, that is steam made by the use of fuel that is composed in most cases of coke breeze, waste, rubbish and general sweepings, and otherwise useless and unsaleable stuff. It also implies a smokeless chimney, and a high-duty from the boiler. Nor must the high-duty be obtained at the expense of the boiler-life. Machine-stoking, provided that a well-designed and suitable machine is fitted, is invariably a preservative of the life of the boiler.

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Are the ACME of
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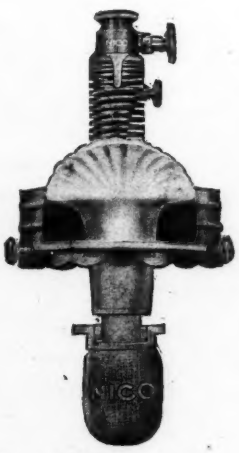

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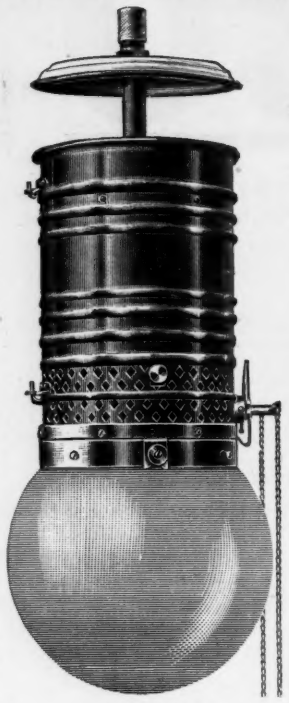

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THE MOST ECONOMICAL LAMP EXTANT.

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The Bottom Plate is instantly removable with flues for cleaning purposes.

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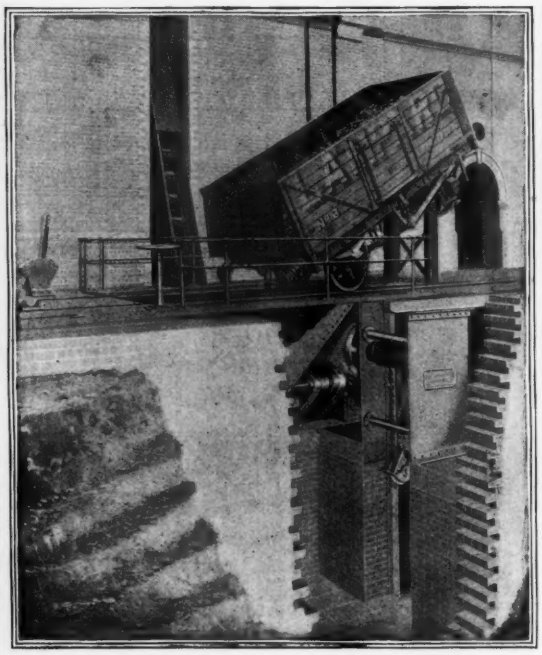

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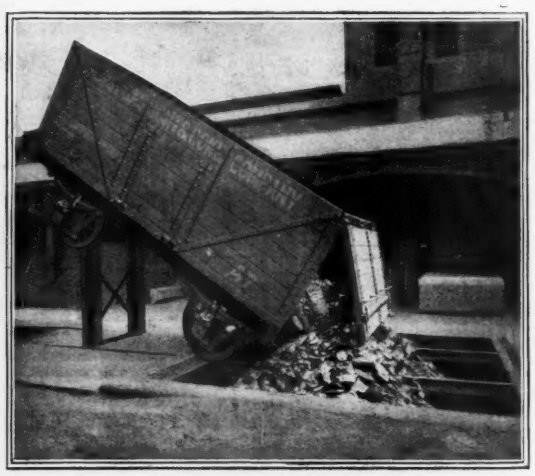

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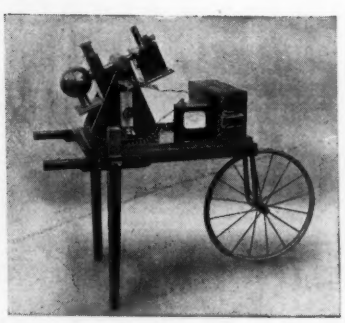

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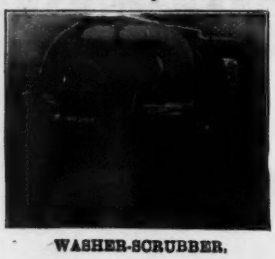

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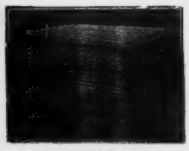

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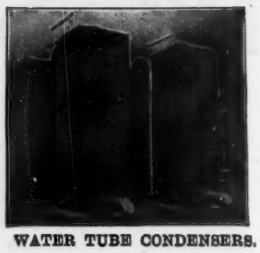

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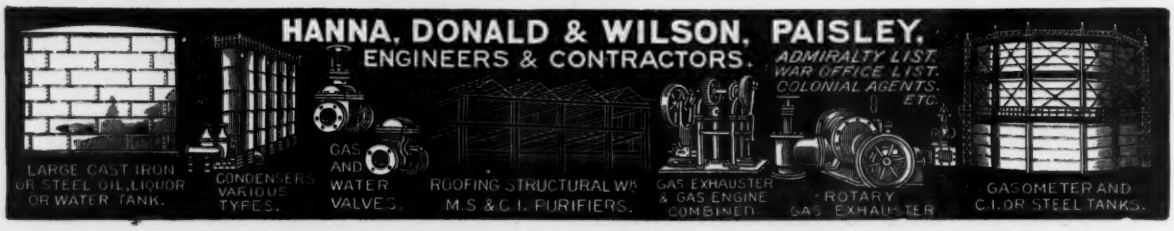
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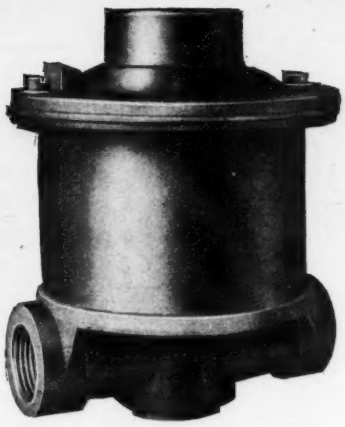

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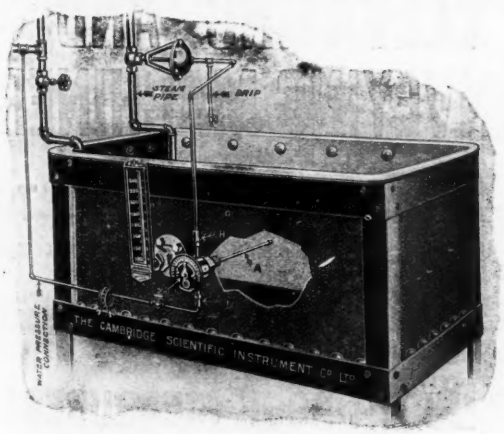

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That is why

"VOELKER" LOOM WOVEN MANTLES

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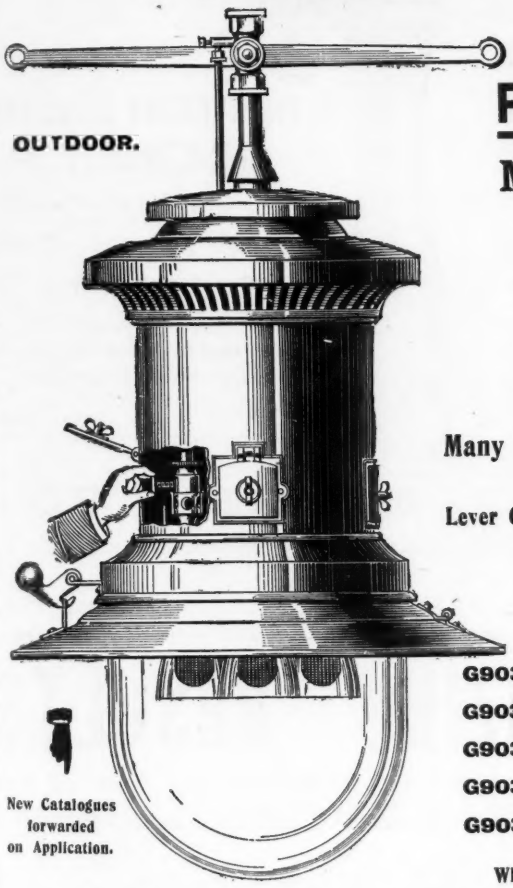

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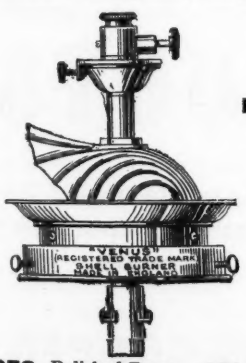

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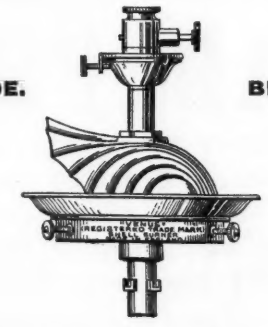

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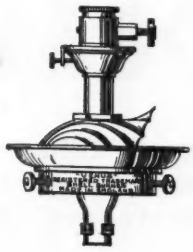

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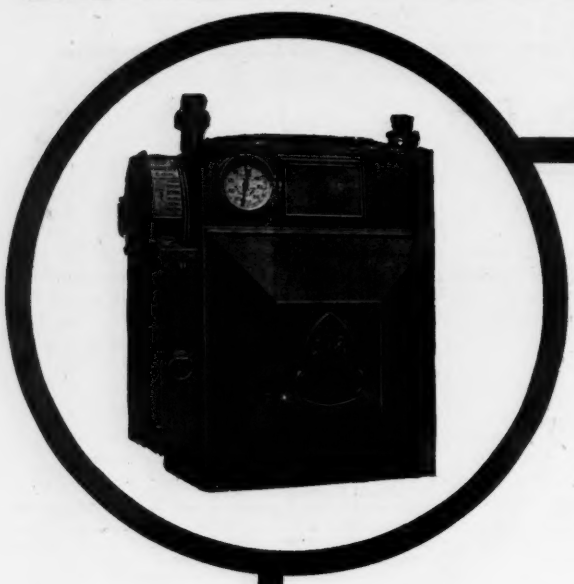

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EDITORIAL NOTES—GAS, &c.

Legislation and Economy.

A FACT that obtrudes itself prominently in the thoughts of those who, during the greater part of their active existence, are engaged in and upon the affairs of the gas industry is that practically all the operations of the industry have undergone within memory a vast change; and there is satisfaction that the industry has shown vitality and innate ability sufficient to keep pace with the demands made upon it. And this despite the fact that its feet are still clogged by unnecessary restriction, though there has been some relief. Great as has been the development of the industry in usefulness in the service of the community, and in fostering the economies of our daily life, the expansion in both directions would be more active if the industry had still more freedom. The industry has now to obey the laws of competition and supply and demand, says Mr. J. H. Canning, in the thoughtful and inspiring address that he delivered to the members of the Welsh District Institution last Wednesday. That is true; and the laws of competition and of supply and demand are, within limits, a sufficient protection of the interests of communities in relation to gas. But we have to look at this matter from the point of view not only of the idealist who claims complete liberty for the gas industry, but from that also of the actualist who deals—confessedly sometimes in too rigid a manner—with the real and practical. The gas industry is one that cannot brook the most open competition if it would carry out its functions in the most economical manner. It is not as other commercial undertakings that can carry on their operations without special accommodation. Therefore, it needs a certain amount of protection and the concession of certain privileges; and for this there must be an amount of countervailing obligation, which can only be realized through the imposition of conditions. If the gas industry had perfect freedom, no undertaking could claim the right of individual protection and privileges. And that full freedom would, in the nature of things, have to be accompanied by an exposure to free competition in gas supply, which would produce the old conditions of public inconvenience, uneconomy, and waste, and even insolvency on the part of those concerns that, being in some way the weaker, had to go to the wall. Such conditions would not be to the benefit of industrial or public economy.

We do not understand Mr. Canning to claim the complete stripping of the industry of restriction and obligation, and the conferment of the fullest freedom; but his words give the opportunity for pointing out that, under the conditions of gas supply (or electricity supply for the matter of that) liberty undefined would not be, in the general interests, politic or desirable. But there is a difference between a sufficient obligation and the inflexible or onerous restriction that imperils economical service under the prevailing circumstances. And it is against the latter that there has to be war; for anything that imperils economical service is superfluous, and a hindrance to progress, and the sharper its removal the better. Of the restrictions still in force, "there are many," says Mr. Canning, "whose careful revi-"sion would be most decidedly to the public advantage; and "united action on the part of gas undertakings to procure "such a revision of the General Acts applying to an industry "would at the same time both enable competition to be "better encountered, and benefit the consumer." Agreed. But this brings us to an important point. It has long been felt that nothing but united and persistent action on the part of gas undertakings will bring about the revision of the General Gas Acts that is so desirable, and the revision that has been so long overdue. The question at once faces us, Where is the body fitted and qualified to bring about this united action? And there we have a subject on which the President of the Welsh Institution might have had something to say that, judging from the remainder of the address, would have been very much to the point, and would have supplemented the lines of thought in the address delivered by Mr. J. W. Helps as President of the Institution of Gas Engineers. The General Gas Acts are much out of sympathy with the circumstances of the times. They want to be consolidated, after undergoing a thorough treatment, involving extermination of decree contemporaneously inconsonant, emendation, and supplement. The fighting in Parliament during the last ten years, started and led from gain to gain by Sir George Livesey—the greatest of the gas industry's legislators—has left the impression upon Parliament that some of the general laws applying to the gas industry are not in harmony with current requirement. For example, such an acute observer of events (and assessor of their import) as Sir Henry Kimber, who presided over the House of Commons Committee on the Standard Burner Bills this session, was convinced that the proceedings on these Bills had brought us nearer still to the revision of gas legislation. The matter is ripe; the time is opportune. But there is the question, who is to assume the lead?

There must be some competent body to take the initial step; and such a body can only be one that is representative of all the various interests of the industry. The narrowness of the representation of the Institution of Gas Engineers puts that organization out of court for leading the way in any legislative reform. As constituted, it is a professional body pure and simple; and its pecuniary means and machinery generally are not equal to such a necessary piece of work in the interests of the gas industry. Nothing really effective could be done by it in this connection. If the gas industry, as such, had an organization (with influential representation and a respectable money backing) that could speak and act in the name of the whole industry, and not of its technical officers only, that organization could appoint a Committee—comprising technical, commercial, financial, and legal gas experts—to prepare a draft Bill with useless laws repealed, and new and suggested ones inserted, and so show the Board of Trade and parliamentary authorities what were the well-considered views of the gas industry on this matter. The making of industrial laws is not work for the legal element only. Here we are, however, a big and influential industry, with nobody in a position to take initial action in this legislative cause on behalf of the whole industry. Most things are left to individual effort; but here is something that is too large for any but a fully representative body to handle. It is all very well to go to the Board of Trade, and say "We should like the General Gas Acts "revised, if you please;" it would be much better to go to the Board, and say the same thing, and illustrate there and then, in tangible manner, the way in which the industry would like to see the work performed, or, in other words, the character of the revision. Neither the Board nor the parliamentary authorities are above suggestion being put into practical form.

A few words in the address has induced us to run away from its lines. We were on the point of the removal of superfluous restriction; and Parliament has to be shown the *raison d'être* for the claim. The economy to the community and the convenience of the service provided by the gas industry are among the reasons that can be advanced. There was much being professorially said recently as to the waste of the domestic coal fire. Mr. Canning gives, in association with the subject, a good illustration of how the gas industry has promoted national economy, when he says that most articles of popular consumption—among others coal—has increased in price, but simultaneously, generally speaking, gas has decreased in price. Of course, the President does not intend the foolish interpretation of his words, that the dearer the raw material, the cheaper the supply of gas. His meaning is that the economies achieved by the gas industry have been such that while the normal level of coal prices has ascended, the normal level of gas prices, through these economies, has descended. That is an important point in favour of the claims of the industry; and

it can be accentuated by the economies and sanitary improvements that the extended use of gas produces in our daily and urban life. But besides the legislative aid to economy by the reduction of regulating stringency, much can still be done within the industry to promote and realize economical service, on the best possible lines. In this direction, Mr. Canning found subject-matter, more especially in relation to the commercial department, that formed not the least interesting portion of his address. He associates himself, too, with the current co-operative and educational efforts; and he closes his address with an optimism regarding the future that, being possessed by the industry's workers generally, carries them along in the excellent work of doing a part individually to make the industry, in some degree, and in some respect, greater day by day.

Thermal and Thermo-Dynamic Efficiency of Gas in Practice.

Review of the present position of things in any direction, together with deduction from what is found, is always a good educational exercise; but the deduction must ever be safeguarded by remembering that it is only made on the knowledge as it exists at the time. The things of yesterday are often not the things of to-day or of the morrow. Mr. Thomas Canning, in the paper he, at considerable labour, prepared for the meeting of the Welsh Association, on the subject forming the above title, brought into comparatively narrow compass some of the main matters comprised in that vast field of interesting research and practical application in which so many workers and investigators have dwelt. It is a very useful work that he has performed in this connection; and in the small amount of deduction that he makes from accumulated knowledge, he does not dogmatize. We rather think that Mr. Canning is one of those who believe that the gas-engine has about reached the end of its possibilities in respect of thermal efficiency. If so, he may be right; but we cannot help thinking that, in connection with the gas-engine, knowledge is in somewhat too chaotic a condition for any asseveration on the subject. As he points out, many people to-day do not know to what degree of efficiency the gas-engine has arrived. The development of the efficiency has been so rapid, and there are so many old type and consequently less efficient engines still in use, that the general character of the gas-engine suffers lamentably; and so the preservation of the ancient types acts both detrimentally to the machine and to gas, and in favour of the electric motor. Say, an old gas-engine, extravagant in its fuel consumption, breaks down through sheer old age. The electrical man hears of it, rushes in with an electric motor, and shows a saving on the effete old engine; and the wonderful performance and relative costs are blazoned forth in the electrical press and advertising literature as a fair sample of comparative merit. The user, too, circulates his views.

The fact, however, as previously remarked, is that the gas-engine has made distinct strides in efficiency during comparatively recent years. Mr. Canning quotes some figures from the report of the Institution of Civil Engineers Committee of 1906, in which the thermal efficiency of a 5-horse-power engine, running at full load, is given as 29 per cent., a 25-horse power engine as 35 per cent., and a 50-horse power engine as 31·8 per cent. There is a notable difference between the 25-horse power and the 50-horse power engines in respect of the figures; but good as that 25-horse power engine was—35 per cent.—in the thermal efficiency, Mr. Dugald Clerk in 1909 was talking, before the British Association, of further actual progress—to 36·8 per cent. This is gratifying; and though there must be limits to the thermal efficiencies of gas-engines, we are not going to admit that these limits have yet been reached. It may be that they have been on the old lines; and that to make further progress, there will have to be some vast change in the actual thermal cycle used. But if there was any general definite feeling among the highest experts and students that the boundary line had without doubt been already attained, we hardly think that the British Association Committee on Gaseous Explosions would be spending so much time over the internal combustion engine as they have been and are doing. They are surely hoping for some effective results to accrue from their labours. Judgment may well therefore be suspended.

Though Mr. Canning is impressed from his investigation that we are approaching the realization of the ideal efficiency in the case of gas-engines, he looks hopefully to a higher thermal efficiency being achieved in the case of gas-fires. He draws upon the last report of the Gas-Heating Research Committee of the Institution of Gas Engineers. In connection with that report, we were recently showing that certain makers have already exceeded the radiation efficiency disclosed by it, by reaching the figure of 50 per cent. He thinks that the essential elementary conditions in the case of a gas-fire are comparatively high pressures and a wide surface—not a deep bed—of "glow-fuel." It is for the gas supplier to give the one, and the makers of gas-fires the other. These are not at all difficult matters, though there must be limits to the pressures used in connection with gas-fires, if unpleasant roaring is to be avoided. Extremely high pressures can be the vogue in industrial heating work, and the efficiency can be increased in connection with certain operations, but that is quite a different matter from domestic heating. It is interesting to note the use by Mr. Canning of the term "glow-fuel," in contrast with the plain term "fuel," or the one suggested at the last meeting of the Institution of Gas Engineers—"radiants." Regarding both gas-engines and gas-fires, Mr. Canning gives some wise and homely advice that all engaged in the commercial work of gas undertakings would do well to thoroughly consider; and we think that, for the most part, all will be prepared, if not doing so already, to follow the counsel.

In the Distribution Department.

At the meetings of the Institution of Gas Engineers and of the District Gas Associations, the subjects introduced for consideration appear to have obtained, by custom, a sort of monopoly. Therefore, proper though the ambition be of gas engineers and managers to make progress in the more imposing technical and commercial aspects of the gas business, it is refreshing to break away for a time from their contemplation and discussion, and to be reminded that underlying them there are questions, involving managerial method, that are contributive to the making or the marring of economy. Mr. John Lewis, the Chief Distributing Engineer of the Newcastle and Gateshead Gas Company, so reminds us in the Presidential Address that he delivered to the North of England Gas Managers' Association last Saturday, by dealing with affairs that come within his own special province. And this also reminds us that, great and important as the distribution department of a gas undertaking (including the commercial work) has become, this is the first time a gentleman whose official position is purely that of Distributing Engineer has occupied the presidential chair of one of the industry's technical organizations; and the North of England Association are deserving of thanks for righting an apparent neglect caused by habit and by oversight of one change among the numerous modern changes in the conditions of gas supply.

Of late years, it has become a stereotyped remark, by chairmen at meetings of gas shareholders, that the distribution department has come much to the front, and that the department now represents year by year a greater proportion of the expenditure of gas undertakings than it did formerly. Without explanation beyond the fact, the statement seems to be censorious, and saddles the distribution department with a sort of stigma over its increasing prodigality; while the truth is that honour in the success of a gas undertaking is to-day (readers must not here be hypercritical in the matter of quantitative definition) about equally divided between the manufacturing and the distributing departments. However successful the manufacturing work of a gas undertaking may be, unless the distribution and commercial department is well organized, and managed with spirit, acumen, and circumspection, it may sadly negative all the financial economies that the manufacturing department may yield. And transposing the departments in the statement, the truth of the assertion still stands. It is upon the co-efficiency of the two departments that financial success relies more than ever to-day. And the technical knowledge required in, and the commercial responsibility of, the distribution department of a large undertaking are so extensive, that perforce the duties must be detached from the pure engineering and general management of the concern if they are to receive the due attention that is imperative for the best and for enduring success. To accentuate this, the eye need only glance at the remarkable comparative figures, appearing early in Mr. Lewis's address, referring to a decade's growth in the volume of business done by the

Newcastle Gas Company. Statistics are often impressive; and these certainly are.

With the distribution department taking such an important place in the success of a concern, it devolves upon those who are entrusted with the responsibilities of chief departmental officer to see that the organization is of the very best, and that materials and costs are under adequate and systematic control. This is the principal message, the outstanding piece of counsel, in the presidential address before us. In one direction in which the organization of the distribution department of the Newcastle Gas Company has been improved from previous condition, has been by the institution (through the instrumentality of the Secretary, Mr. Thomas Waddom) of a "job cost system." The result justifies the devised means. To this system the address is chiefly directed; and the President enters into it with zest and in full detail—in just such a manner, in fact, that the heads of the distribution departments of other gas undertakings can make step-by-step comparison in this regard of the Newcastle methods with their own. The address will be most useful and suggestive to those who are *au fait* with the detail of routine in the same connection; and, to some good purpose, they may consider and discuss it. The opportunity is given by the reproduction in our columns of the address *in extenso*, with illustrations of the cards and sheets used in the progress of the system from its initial stage to the end. Suggestion may be found that will inure to the improvement of the systems adopted by other undertakings; and, on the other hand, the distribution expert outside Newcastle may be able to suggest improvement in the methods that Mr. Lewis has submitted to critical judgment. There is one thing certain; it is that the objects of the system—expedition in the execution of work, prevention of waste, and the accurate allocation of expenditure—are all secured, or the system would not continue to form part and parcel of the administrative practices of the distribution department at Newcastle. But to adopt the words of the President, "this, like many other systems in business, "merely provides information; and it is by the intelligent "use of such that the benefits are to be derived."

In the concluding part of the address, Mr. Lewis treats of a number of miscellaneous subjects which we will only touch slightly here to indicate their nature, and to direct to them the attention they deserve as bearing upon the economies, immediate and prospective, of the work of the distribution department. There is condemnation of the policy of purchasers always trying to run down prices of materials and goods. This, with competitive price-cutting, can only result in well-known and positive evil effects. Cheapness ground down to its finest point does not indicate a sound policy in reference to the future, nor a due regard for encouragement or for that ethical principle (too often grossly abused) of "live and let live." In the cause of economy, Mr. Lewis revives an idea that has had expression before regarding the establishment of a central testing-place for new gas-consuming appliances, so that the contributors to the support of such a place might have the reports on the results of tests for their private information and guidance. The idea is good; but there are difficulties. Among other considerations, the examiners would have to be men of the highest rectitude and reliability, as the temptations would be many, and an error in manipulation or judgment might work an untold injury. Finally, there is in the address an amount of encouraging information as to the large trials in the area of the Company with mechanical street lighting and extinguishing devices. The result of the experience may be summed up in the President's own words: "In my "opinion, the feasibility of pressure lighting has been estab- "lished. But under certain conditions, it is not desirable "to operate apparatus over large areas where district "governing does not exist, or where the cost of its installa- "tion is prohibitive. In such cases, the difficult portions "of the area can be operated by the clockwork system." There Mr. Lewis shows his disinterestedness, by defining a field of usefulness for both the pressure and the clockwork lighting and extinguishing devices.

Rebates for Gas for Heating Purposes.

Most gas undertakings are now looking for business extension in the large field offered them by domestic heating. In the old lines of business, the annual rates of increase, in new connections and volumes of business per connection, are on the decline. This must be so the nearer the line of accrued business in any direction approaches the saturation level, and as building development in a district proceeds at a more modest pace. Under these conditions, new methods of "business-getting" have to be adopted; and in opening up a new line of business, it may be that terms that applied to pre-existing lines of business may not be the most suitable. The old proneness of the gas industry to be conservative, and to be faithful to the ancient ways, has been largely expelled; and the spirit of freedom in commercial transaction now almost generally pervades the industry. Where it does not, then all the worse for the undertakings concerned. Those are the undertakings with administrations out of gear with the times, and administrations who have not grasped the elementary truth that opportunism, legitimately practised, is not a trait to be despised in trading.

Now it has to be confessed that, for a large development of the heating business—the branch to which the eyes of the industry are turned for future lucrative expansion—the price of gas in many broad areas is too high for any extensive placing of gas-fires; and there is another consideration, that numerous householders require something more than the inducements of cleanliness, convenience, labour-saving, and so forth, to prevail upon them to give up that idol of domestic veneration, the coal fire. What people suffer, and what they put up with, in defence of the old occupant of their hearth, and in defiance of the dictates of the spirit of greater refinement that permeates current conditions of life, supply a testimonial to the tenacity of human nature to tradition and custom when it has set itself to be obstinate as against reform. There is, under the circumstances, a necessity for it to be weaned; and something seductive has to be offered. Human nature has, in trading, a fondness for rebates or, to use the more popular expression, discounts; and, as we were saying last week, the discount system for gas consumed for heating purposes has (without dual piping and meters) been used with beneficial effect in developing this line of business. Very kindly, Mr. R. W. Edwards, of Aldershot, has complied with a suggestion made by us that he should, for the benefit of the gas industry at large, relate the experiences of his Company in this development of their "business-getting" methods. New concrete experiences of this sort are what are wanted; and they are welcome. And we undertake to say that this article, in these days of a wide-awake commercialism, will be read near and far, and with more than ordinary interest.

The Aldershot experience with the discount system has been in the development in the outer district of the use of gas for cooking and heating. In these out-districts, the ordinary price of gas is higher than in the home district; and therefore it was more difficult there to create new business in cooking and heating. A modest all-round reduction applying to all classes of consumption would not have given any special fillip to the employment of gas as fuel; but a sixpenny rebate put a different complexion on the matter in the eyes of the householder. And quite a considerable number of householders have been found ready and willing on the offer of the rebate to pay a rent of 6d. a quarter per discount meter fixed (or as Mr. Edwards prefers to call them, "rebate indicators") and to bind themselves to pay their accounts, as a further condition entitling to rebate, by or before the last day of the month succeeding the quarter to which the accounts apply. This inducement to prompt payment is a secondary advantage to the primary one that induced the inauguration of the system, although the condition is not enforced in any arbitrary or unreasonable spirit. The consumers appreciate the new plan; and it is now an inherent part of the Company's commercial system, gaining what they required where the higher prices ruled—substantial increases of gas consumption, as is shown by Mr. Edwards in the examples of accounts that he cites.

The experience of the system at Aldershot can be summed up in few words: It is an effective system; and it pays. It helps to broaden the basis of the gas business; and a broadened basis, composed of a good diversity of business, is what is needed in resisting the attacks of competitors that were never so strong as they are to-day.

Improved Working Results in Dublin.

It must have been with considerable satisfaction that Alderman W. F. Cotton, the Chairman of the Alliance and Dublin Consumers' Gas Company, rose, at the half-yearly meeting of shareholders last Friday, to move the adoption of the report and

accounts for the six months ended the 30th of June, inasmuch as they furnished evidence of successful working under new conditions which it might have been expected would not have conduced to this result. The Company were in Parliament last year; and, in order to meet the views of the Municipality of Dublin, they consented to make a considerable reduction in the price of gas, which would cause a difference of nearly £25,000 a year in the revenue from this source. Yet the result of the half-year's working was a profit, with the addition of a small amount carried forward, of £40,903, which allowed of the payment of a dividend at the rate of 5 per cent. per annum, with £4369 to the good, whereas in the corresponding period of last year the reserve fund had to be drawn upon almost to this amount to pay the same dividend. How was it done? Alderman Cotton furnished the explanation in his address, which is reported elsewhere. First of all by improved working in the retort-house, where, according to the old axiom, dividends are made. Not only had the production of gas per ton of coal carbonized been greater, but the yield of residuals had increased; and while these brought in £19,367 in the half year ended June 30, 1909, in the past six months they realized £24,373. A large number of additional automatic installations were put in during the half year; but, as Alderman Cotton pointed out, there is room for an extended use of gas for other than lighting purposes in Dublin. Under the Company's new Act, the illuminating power of the gas is 14 candles; and the change gave rise to some complaints of "bad light." But, as usual, the fault, in most of the cases, lay with the burner; and therefore Alderman Cotton did well to condemn the continued use of wasteful flat-flame burners when the consumers can avail themselves of the more economical system of incandescent lighting, especially as, under the new conditions, facilities have been afforded for doing so. Twelve months ago, no one would have anticipated so favourable a result of the forthcoming year's working as that which the Directors have been able to present; and they and the officials well deserved the thanks accorded to them by the shareholders.

Exit the Hythe Coalite Plant.

Can it be true? Over the telephone the other day came the words: "You said in an article on 'The Coalite Position' this week, 'the Hythe plant, it is believed, has not been restarted yet.'" The words were remembered. Then came this startling statement: "Well, I have heard, on very good authority, that an old iron dealer has purchased the plant for £200. He estimates there are about 300 tons of old iron in it; but in view of the cost of getting it away, he could not afford to pay more for it." This plant from beginning to end must have cost a few thousand pounds; and is this really the termination of an existence that was trumpeted so loud and trumpeted so long as offering to gas-works generally an example worthy of their emulation? Those "Times" advertisement articles, florid and costly; those platform speeches, bold and flattering; those demonstrations, convincing to a few smoke-wearied ones—how they all shrink before the announcement that this young incorporation in a gas-works has, so soon in its career, passed into the hands of an old-iron dealer. If the answer to our opening question is in the affirmative, we hope the friends of Professor H. E. Armstrong will keep the sad tidings from him.

Wireless Electric Ignition and Extinguishing of Gas-Lamps.

Some time ago we heard of an inventor who in his own town was doing great things in the electric ignition and extinguishing of the gas-lamps. By a small electrical contrivance fitted on to the incandescent burners of the public lamps, and an electrical transmitting arrangement on his motor car, he could flit through the streets, and, by touching a button on the electrical contrivance on the car, light up the whole of the lamps. No wires and no connection of any kind, beyond those mysterious waves through space which enable Marconi to confer so much advantage on mankind. The inventor, it was said, could also stand at the end of a street and light up or extinguish the lamps in it one after the other. In his own house, when friends were assembled, he would go (the story ran) to the bottom of his garden, and astonish the visitors by lighting up the lamps in the rooms where they were sitting. The absence of all signs of human agency must have been weird. When we heard of this, we refrained from publishing the statements, in the hope that something more definite would come to hand; but there is a reminder of the story in a message, headed "Wireless Lighting," from the Copenhagen correspondent of the "Daily Telegraph." We reproduce the message without further comment: "The well-known Danish inventor, M. Valdemar Poulsen, who has for a long time made a special study of wireless lighting, carried out a successful experiment to-day [Friday]. While his assistant stood in one room holding two incandescent lamps, the inventor went to another room and placed his transmitting apparatus in position. On pressing the two contacts, the lamps were lighted and extinguished. There was no connection of any kind between the apparatus and the lamps."

Automatic Lighting and Extinguishing of Gas.

In another part of the "JOURNAL," there appears a "Communicated Article" on this subject—the contribution mirroring the results of a studious examination, on the part of the writer, of the various automatic ignition and extinguishing devices for street-lamps now inviting favour. The article is critical in its character; and we can imagine that the advocates of both pressure and clockwork devices will have something to say on the criticisms as to the limitations of their respective systems, and possibly there will be a controverting of some points raised. An article of this kind does no harm; it offers a base for discussion. Certain of the points in it have, we know, been present in the minds of engineers who have contemplated the recommending for adoption of some means of dispensing with the cumbrous mode of hand labour in lighting and extinguishing street-lamps. They at all events would welcome discussion by the experts in this matter.

Inauguration of the Manchester University Lectures on Gas.

Mr. Franklin Thorp, the President of the Manchester and District Junior Gas Association, was quite justified in characterizing last Saturday as a "day of days" to be remembered by the gas profession, inasmuch as on it they witnessed the realization of ambitions long hoped for, and the beginning of a relationship of the members with the University which would be fraught with great advantage. His remarks were made at the inauguration of the series of lectures on the "Science of Gas Manufacture and Combustion," which, as mentioned in the "JOURNAL" last week, have been arranged by the Manchester Junior and Senior Gas Associations in co-operation with the authorities of the University. The scheme, which is the outcome of a suggestion by Mr. Thorp in his Inaugural Address early in the year, has had the hearty support of Professor Harold B. Dixon, the head of the Department of Chemistry of the University; and he gave it a good send-off by delivering the first lecture, an abstract of which appears elsewhere. The movement also has the cordial approval of the Vice-Chancellor (Sir Alfred Hopkinson), who expressed his regret at being unable to be present on what he regarded as an "auspicious occasion." In his introductory remarks, Professor Dixon welcomed the beginning of what he hoped would be a lasting connection between the University and the gas industry of the Manchester district. At the same time, he took the opportunity of congratulating the gas profession and the University of Leeds on the founding of the Livesey Professorship of Fuel and Gas Engineering; and he said that in Manchester they desired in a more humble way to connect their department with the gas engineers of the district "for their mutual advantage." The interest shown in the lectures, which are free, was evidenced by the large attendance on Saturday; and we sincerely trust that there will be no falling-off, but rather an increase, in the numbers on the five succeeding occasions. These are opportunities for the acquisition of knowledge which should certainly not be missed.

The Gas Engineering and Fuel Lectures at Leeds University.—In another part of the "JOURNAL" will be found the principal features of the prospectus of these lectures for the session 1910-11. The teaching staff consists of Dr. W. A. Bone, F.R.S., Livesey Professor of Applied Chemistry (Coal Gas and Fuel Industries), with Mr. Harold H. Gray, B.Sc., as Demonstrator, and Dr. H. G. Colman and Mr. Ernest Bury, M.Sc., as Special Lecturers. The courses have been arranged to meet the requirements of students who are preparing for responsible positions either as gas engineers or in the fuel and metallurgical industries; and their attention is specially directed to the particulars furnished elsewhere.

THE VISIT OF MEMBERS OF THE GERMAN GAS AND WATER ASSOCIATION.

THERE are people whom it is always a delight to welcome as visitors; there are others whom the less one sees of them, the better. Among those whom—professionally and in the true bonds of friendship—it is always a pleasure to see are the members of that influential technical and industrial organization of the great German Empire, the German Association of Gas and Water Engineers. Therefore it was a real happiness that the unfortunate national bereavement at home of a few months ago only meant the postponement of a reciprocation on British soil of the kindness and hospitality that were showered upon members of the Institution of Gas Engineers when they paid their memorable visit to Germany, and chiefly to Berlin, in 1908—the year of the presidency of Mr. W. Doig Gibb. It seems hardly possible that two-and-a-quarter years have spent themselves since then; but inexorable Time will not permit us to lose sight of one of the main facts of life. The memories, however, of that brilliant time are verdant in the minds of those who were privileged to receive the honours of welcomed guests on that occasion.

Nearly six years have elapsed since the Earl's Court Exhibition; and it was in the course of that display of the position of gas progress that the last formal reception of our German friends was recorded. Then the gathering was of international character; France, Belgium, Holland, and other countries sending their professional gas representatives with fraternal greetings, and to learn what Great Britain had accomplished in the interests of the gas industry. Vast and important have been the changes of the intervening time, in all departments of the industry. But what was shown our visitors then were the advances in the means of most profitably using the gas sent from the gas-works into the distribution systems of the United Kingdom. The exhibits of the time have been largely left behind by the further developments of knowledge and by the activity of inventive genius. What is being shown the visitors on this occasion are the large embodiments of advance in representative works (the names of which are industrially world-famed) all tending to the realization of the ambitions of the gas technician—greater economy in the manufacture of the staple commodity of the industry. There is one point that should be here mentioned, as serving as a link between the Earl's Court Exhibition of 1904 and the present visit; and it is that, in 1904, Mr. James W. Helps occupied the prominent position in connection with the exhibition of Chairman of the Advisory Committee; and had the visit this year of our German friends been at the prearranged time, he would have had the honour of receiving them as President of the Institution of Gas Engineers. But unavoidable circumstance delaying the visit, the eminent position of chief representative of the hosts is in the worthy hands of his successor in the presidency, Mr. Alexander Wilson, at whose right-hand side in this visit stands Mr. Helps sharing the pleasures of a happy responsibility.

"Old Sol" did his best on Sunday to add to the heartiness of the welcome accorded the visitors by shedding over land and sea during the morning and early afternoon the brilliance of his rays. But the effort was too great for him to sustain; and the sky was somewhat overcast as the travelling party sped by train from the landing-place on our shores—Dover—to Charing Cross station, during which journey they were able to see something of the beautiful south-eastern portion of the country in its autumn garb. The train conveying the visitors reached its destination about 5.20 o'clock; but some time before, some members of the Institution Reception Committee assembled at the station. There was the President of the Institution (Mr. Alexander Wilson), who had travelled up from Glasgow specially in time to be present at the incoming of the guests; there was the ex-President (Mr. J. W. Helps), the Hon. Secretary (Mr. S. Y. Shoubridge) was present, and other members of the Committee were: Mr. H. F. Andressen, Dr. Harold G. Colman, and Dr. Rudolf Lessing. The Secretary of the Institution (Mr. Walter T. Dunn) was also in attendance. Several of these, the visitors knew well, through the Berlin visit, and individual trips paid between Germany and this country, and *vice versa*. It is convenient to interpose here a full list of the names of the gentlemen constituting the Reception Committee. They are: Mr. H. F. Andressen (Imperial Continental Gas Association, London), Mr. J. Ferguson Bell, Dr. Harold G. Colman, Mr. Thomas Goulden, Mr. R. S. Gardiner, Mr. W. Doig Gibb, Mr. Thomas Glover (Norwich), Mr. W. R. Herring, Mr. Charles Hunt, Mr. J. W. Helps, Mr. H. E. Jones, Mr. Stanley Jones, Dr. R. Lessing, Mr. F. D. Marshall, Mr. S. Y. Shoubridge, Mr. R. G. Shadbolt, Mr. Alexander Wilson (*President*), Mr. A. F. P. Hayman (Imperial Continental Gas Association, Berlin).

The train arrived; and soon the representatives of the Council of the German Association were seen in hearty greeting with the President of the Institution, among them Dr. Karl Bunte, the General Secretary of the Association, whose father, revered throughout the gas industry of the world, was unable (to the general regret) to undertake the journey. There was a mingling then in mutual greeting, accompanied by expressions of the warmest welcome. From the station the visitors were driven in motors to the Westminster Palace Hotel, which will be their headquarters during the visit. The President of the German Association (Herr H. Prenger) was unable to make the journey with the general body of members; but so anxious was he to be with them on Sunday that he made the journey direct from Rome, and reached the hotel at ten p.m.

The list of members who intimated their ability to accept the invitation to participate in the visit is as follows:

COUNCIL—

Herr H. PRENGER (*President*), of Cologne.
„ F. KORDT, of Dusseldorf.
Dr. K. BUNTE (*General Secretary*), of Carlsruhe.
Herr K. HEIDENREICH, of Berlin.

MEMBERS—

Herr Burgermeister ACHILLES, of Sagan.
„ A. ASSMANN, of Homburg.
„ BALLUF, of Wittenberge.
„ O. BENNINGHOFF, of Dortmund.
„ J. BERNAUER, of Budapest.
„ Max. BESSIN, of Berlin.
„ Eugen BLASS, of Mülheim.
„ Richard BLUM, of Berlin.
„ Paul BOTTGER, of Lörrach (Baden).
„ Shirk BOYER, of Charlottenburg.
„ A. BRODMARKEL, of Hof i. Bayern.
„ W. BUEB, of Berlin.
„ H. DANIELS, of Dusseldorf.
„ P. DRORY, of Stettin.
„ Johannes ELSTER, of Berlin.
„ FANAS, of Berlin.
„ A. VON FEILITZSCH, of Braunschweig.
„ E. FISCHER, of Esslingen a N.
„ W. FORTMANN, of Oldenbourg.
„ Karl FRANCKE, of Bremen.
„ F. FRANKE, of Hagen (Westfalen).
„ E. FROITZHEIM, of Cöln-Deutz.
„ H. GERDES, of Berlin.
„ F. GÖHRUM, of Stuttgart.
„ M. HASE, of Lübeck.
„ M. HEMPEL, of Berlin.
„ HILGENSTOCK, of Hanover.
„ O. HUBER, of Berlin.
„ W. JANSEN, of Düren.
„ M. KLÖNNE, of Dortmund.
Dr. O. KNUBLAUCH, of Cöln-Ehrenfeld.
Herr E. KOBBERT, of Königsberg.
„ E. KOHLER, of Metz.
„ H. KOPPERS, of Essen-Ruhr.
„ P. LABRYN, of Wormerveer.
Dr. L. LANG, of Potsdam.
Herr LICHTHEIM, of Altona.
„ B. LOH, of Mülheim a Rh.
Dr. C. LOMSCHÉ, of Iserlohn.
Herr LUTZ, of Hamborn a Rhein.
„ Friedrich LUX, of Ludwigshafen.
„ G. MARTIN, of Erfurt.
„ H. MENZEL, of Berlin.
„ R. MESTEL, of Breslau.
„ E. MEYSTRE, of Vevey (Schweiz).
„ A. MIEHR, of Augsberg.
„ H. MOHR, of Altenburg, Sa.
„ G. MÖLLERS, of Cologne.
„ A. MÜLLER, of Dessau.
„ K. OBERTHÜR, of Kaiserslautern.
„ A. PETERS, of Cologne.
„ K. PFUDEL, of Charlottenburg.
„ H. PIPERSBERG, of Lüttringhausen (Rheinland).
„ R. PIPPIG, of Kiel.
„ H. POHMER, of Mariendorf, Berlin.
„ Otto RAUSCHENBACH, of Stralsund.
„ F. RAUSER, of Berlin.
„ K. REINHARD, of Leipzig.
„ K. RIEMANN, of Rixdorf, Berlin.
„ J. VAN ROSSUM DU CHATTEL, of Amsterdam.
„ VON SANTEN, of Cöln-Ehrenfeld.
„ B. SARTORIUS, of Wittenberg.
„ K. SCHILLING, of Braunschweig.
Dr. E. SCHIRRMEISTER, of Berlin.
Herr W. SCHMIDT, of Dahlhausen (Ruhr).
„ K. SCHNABEL-KÜHN, of Höchst a M.
„ W. SCHNELL, of Freiburg i. B.
Dr. H. SCHÜTTE, of Bremen.
„ W. STAUSS, of Dresden.
Herr E. URFEY, of Wiesbaden.
„ W. VAIGL, of Pilsen.
„ W. WAGNER, of Vegesack.

Herr K. WEILAND, of Ohligs (Rheinland).
Dr. WEIN, of Budapest.
Herr E. WEISS, of Rahnsdorf bei Berlin.
„ WERNER, of Konigsberg.
„ WIRTZ, of Breslau.
„ H. ZOLLIKOFER, of St. Gallen.

It will be seen from the list that there were originally 82 acceptances; and it must be counted as fortunate that only four were prevented finally from making the journey.

The formal programme of the week's arrangements was entered upon at an early hour yesterday morning. There is much to do, and much to see, during the week; and the programme informs us that everywhere that visits are to be paid there is a desire to show hospitality in right true British fashion. But the bountiful provision of pleasure and interest has to be faced; and it was faced at nine o'clock yesterday morning with a good deal of happy anticipation on the part of all, and a little silent supplication for the continuance of bright weather through the space of six consecutive days at least. Fortunately, the weather was kind at the start; and this was a good augury.

The first objective was Beckton. The journey was made by motors; and, seeing that we numbered nearly a hundred persons, the procession made a brave show in London streets. It was noticed that the members generally had armed themselves with a booklet—provided by the Institution Reception Committee, prepared by Dr. Rudolf Lessing, and printed in German—giving information regarding the works to be visited; and the works to come under survey yesterday were Beckton, Kensal Green, and Fulham. Therefore, during this round of inspection, the Gaslight and Coke Company were the hosts. We will not spoil the day's story by any hasty survey; but leave the telling of it until next week.

Arriving at Westminster in the early evening, there was not much time to spare to prepare for the evening engagement. This was a banquet, at the Hotel Cecil, by invitation of the Institution of Gas Engineers.

The itinerary for the remainder of the week will show the full character of the programme provided:

Tuesday, Oct. 4.

A.M.
9.30. Motor-cars leave Westminster Palace Hotel.
10.15. Arrive at the East Greenwich Works of the South Metropolitan Gas Company. Inspection of the Works.
P.M.
1. 0 Luncheon, by invitation of the Company.
2.15 Motor-cars leave the Works.
3.15 Arrive at the Works of the Croydon Gas Company. Inspection of the Works.
4.30 Tea, by invitation of the Company.
5.30 Motor-cars leave the Works.
6.15 Arrive Westminster Palace Hotel.

Wednesday, Oct. 5.

P.M.
11.35 Special train leaves Euston.

Thursday, Oct. 6.

A.M.
7.55 Special train arrives Edinburgh (Princes Street). Breakfast on arrival at Station.
9.40 Special train leaves Caledonian Railway Station (Princes Street).
9.55 Arrive at the Granton Works of the Edinburgh and Leith Corporations' Gas Commissioners. Inspection of the Works.
P.M.
12.30 Luncheon, at the invitation of the Gas Commissioners, in the Technical Office—the Right Hon. the Lord Provost of Edinburgh in the Chair.
2. 0 Motor chars-à-bancs leave Granton Works for Forth Bridge.
5. 0 Arrive back at Caledonian Railway Station (Princes Street).
5 10 Special Train leaves Edinburgh.
6.15 Arrives Glasgow (Central Station).
7.30 Banquet at the invitation of the Gas Committee of the Glasgow Corporation, in the City Chambers—the Rt. Hon. the Lord Provost of Glasgow in the Chair.

Friday, Oct. 7.

A.M.
9.30 Motor-cars leave Central Hotel.
10. 0 Arrive at the Tradeston Works of the Gas Committee of the Glasgow Corporation. Inspection of the Works.
11. 0 Motor-cars leave Tradeston Works.
11.20 Arrive at the Provan Works. Inspection of the Works.
P.M.
1.15 Motor-cars leave the Works.
1.35 Arrive Central Railway Station.
2.10 Special Train leaves Central Station. (Luncheon and Dinner will be served *en route*.)
10.55 Arrive Euston. Motor-cars will meet the train.
11.30 Arrive Westminster Palace Hotel.

Saturday, Oct. 8.

P.M.
1. 0 for 1.30. Luncheon at the Garden Club of the Japan-British Exhibition, by invitation of the Institution of Gas Engineers.

ECONOMICAL ASPECT OF STREET-LAMP IGNITION AND EXTINCTION BY PRESSURE.

A RECENT number of the "Journal für Gasbeleuchtung" contains some short communications on this subject. The first is by Herr Göhrum, the Manager of the Stuttgart Gas-Works. He points out that a general conversion from hand lighting and extinction to the use of lighting and extinguishing appliances operated by increase of gas pressure can only be made after exhaustive trial of the latter appliances. An indirect advantage, however, of lighting by increase of pressure is that it draws attention to mains which are of insufficient size for the needs of the consumers; and it is to the financial interest of a gas undertaking to enlarge the distributing system to meet the increase in the demands of consumers. For instance, the author found that a consumer, before the main from which he was supplied was enlarged, paid a gas account of about 43s. per annum. After the distributing system had been overhauled and the pressure increased from 15·10ths to 22·10ths, his gas account amounted to 56s. to 58s. per annum. The unaccounted-for gas at the same time fell off, because the distributing pressure at the gas-works was reduced from 35·10ths to 18·10ths. A further advantage of the wave of increased pressure is that it calls attention to blocked or badly governed burners, and almost compels the adoption of properly-regulated burners. This brings with it an improvement in the conditions of lighting, and acts favourably to gas in its competition with electric lighting. Considerable economy may generally be shown by calculation to be likely to ensue on the introduction of pressure ignition of street-lamps; but it should further be considered, before attempting it, whether it is practicable from the technical standpoint. The distributing conditions must be favourable, and the waves of pressure must not affect the contents of the gasholder unfavourably. After reconsideration of estimates which he had previously made, in consequence of objections raised to them by Herr Buhe, of the Dessau Gas-Works, Herr Göhrum comes to the final conclusion that the adoption of pressure ignition effects an economy of about 10s. per lamp per annum.

The next communication is by Herr H. Dobert, the Manager of the Geestemünde Gas-Works. He points out that only a few tenths pressure are requisite to operate the "Bamag" pressure igniting apparatus, and that the maximum pressure increase required to ensure satisfactory working is from 8·10ths to 12·10ths. A previous report by Herr Buhe, to the effect that a pressure of 53·10ths was required at Breslau, indicates that the maximum evening gas pressure there must amount to 40·10ths, even when no pressure igniting apparatus is employed. Probably this means that the gas-works at Breslau are at a great distance from the chief area of gas supply, and that the pressure will have fallen to the normal in the course of the transmission of the gas through the long mains from the gas-works to the district. Objections to pressure ignition, on the ground that the high pressure is detrimental to the operation of inverted burners, are generally due to the impression that the increase of pressure requisite is considerable. In the case reported, where the maximum pressure in parts of the town may already be 40·10ths, a wave of increased pressure bringing the maximum pressure up to about 53·10ths means an increase of pressure of only about one-third, which will not cause any serious disturbance of consumers' burners if they have been properly regulated. Other objections raised by Herr Buhe to pressure ignition are: (1) That the risk of explosion where wet meters are used is greater; and (2) that the gasholder accommodation is not fully utilized. These points cannot be dealt with except with reference to the local conditions in the case referred to by Herr Buhe; and he has not given sufficient details in regard to them. Herr Dobert does not consider it necessary to discuss the question of interest and depreciation charges on the capital outlay on pressure ignition, because he finds that the economy in wages and gas effected by the adoption of the system wipes out the expenditure thereon in a space of about three years. The system of pressure ignition has now been adopted in so many towns in Germany that its advantages may be regarded as sufficiently established. Not the least of them is the means it affords for igniting and extinguishing street-lamps at the proper time, and thereby enabling gas to compete more effectively with electricity for public lighting.

The third communication is by Herr Buhe, the Manager of the Dessau Gas-Works, and is written by way of comment on the foregoing communications. Herr Buhe emphasizes the point that his investigation of the conditions at Breslau showed that pressure ignition was not satisfactory. He expressly limits his unfavourable conclusions to this particular case, and does not contest the view that in favourable local conditions pressure ignition may prove remunerative to a gas undertaking. He thinks, however, that in towns of the size of Breslau, and even in many smaller towns, the conditions of the works and distributing system are not favourable to the employment of pressure lighting devices, and that the latter may give rise to considerable difficulties. He believes that many gas men have formed the same somewhat unfavourable opinion as himself with regard to the general adoption of such a system of lighting street-lamps. In conclusion, he says that pressure ignition does not present advantages for all towns; and that before introducing it, the local conditions must always be thoroughly investigated.

GAS ACTS FOR 1910.

[Second Article.]

The Bills promoted by gas companies already in possession of statutory powers were few this session. Excluding the three Standard Burner Bills, there were only seven; and one of these, the Ammanford, was abandoned. The Standard Burner Bills still await third reading and Royal Assent.

The further powers sought by the Brighton and Hove Gas Company have been obtained. They have been empowered to sell and lease lands belonging to them which may not at the time be required for the purposes of their undertaking; and the entering into agreements with the proprietors of navigations, &c., has also been allowed. Protective powers for local authorities and the Railway Company have found entrance into the measure. The new auction clauses have been granted, as have also been powers to create reserve and special purposes funds. The terms of the capital redemption fund have been somewhat altered from those in the original draft of the Bill ("Journal," Jan. 18, p. 156); and we reproduce from the Act the clause as it now stands:

Whereas under the provisions of Sections 50 and 51 of the Brighton and Hove Gas Act, 1881, the Company were required to cease to manufacture gas or residual products at the Black Rock works of the Company, or, after a period of ten years, at any place within the parish of Hove, and have accordingly abandoned such works, and ceased to manufacture at their then existing works in the said parish of Hove. And in consequence thereof, capital to the extent of £57,000, or thereabouts, of capital expended in the works so abandoned has become unproductive; and it is expedient that the Company should cancel such unproductive capital, it is hereby provided as follows:—

(1) The Directors of the Company may, if they think fit, in any half year appropriate out of the revenue of the Company, as part of the expenditure on revenue account, any sum not exceeding £1800 to a fund to be called the "Capital Redemption Fund."

(2) Every sum credited to the said fund shall be applied by the Directors from time to time, and in each case as soon as is reasonably practicable after such sum has been credited to the said fund under the provisions of this section, in purchasing ordinary or preference stock of the Company; and all stock so purchased shall immediately after the purchase thereof be cancelled, and shall thenceforth be, and be taken to be, extinguished; and the Directors shall cause the same to be duly noted as so cancelled and extinguished in the books of the Company. Provided always that all stock so purchased otherwise than in the open market shall be purchased at a price not exceeding the middle price of the then current official quotation for the same on the London Stock Exchange, or at the price (as recorded in the Company's books) at which the last transaction in the same class of stock has taken place, whichever of these prices shall be the lower.

(3) This section shall cease to operate so soon as the Company shall have appropriated and applied as aforesaid sums amounting in the aggregate to £57,000.

(4) The Company shall not re-issue any stock which shall have been cancelled under the provisions of this section.

Section 17 of the Company's Act of 1881, relating to the Directors fees, has been amended, so that it reads, and has effect, as if the sum of £2250 had been inserted in the section instead of £1500 There is provision for the reduction of the number of auditors to two in the event of any of the present auditors ceasing to hold office; and no one will in future be newly elected to the office who is not a professional auditor. This, however, will not affect the appointment of a Special Auditor by the Brighton Corporation under Section 21 of the Company's Act of 1866. A variation is made in the prescribed times of holding the half-yearly meetings, by the naming of the months of February or March and August or September. The standard price of 3s. 3d. proposed in the Bill, it will be remembered, was, under the special circumstances of the powers granted to the Company, brought down by 1d. Therefore, in Brighton, Hove, Preston, and Aldrington (comprising the inner area), the standard price will be 3s. 2d., with the sliding-scale operating half yearly. The proposed additional charges in the outer area have been reduced; and now it is decreed that, in the parishes named, the price for the time being charged by the Company in the inner area is not to be exceeded by more than the following amounts: In Portslade-by-Sea, New Shoreham, and specified parts of Southwick, Kingston-by-Sea, and Old Shoreham by 3d. per 1000 cubic feet; in other described parts of Portslade, Patcham, Southwick, and Kingston-by-Sea, and part of Rottingdean, 6d.; in Lancing and Overdean and the remainder of Old Shoreham and Rottingdean, 1s.; and in any other parish or place within the outer area, 1s. 3d. Lower prices may be charged, providing they are not less than those ruling in the inner area. The prepayment clause appears; but the variation in the Bill, as to the charge for the hire of a prepayment meter, without fittings, not exceeding the rate of 17½ per cent. per annum on the cost of the meter and its fixing, has been brought to the ordinary form of 10 per cent. per annum on the cost of the meter. The standard illuminating power of the gas is proposed at 15 candles, as tested by the "Metropolitan" No. 2 burner. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

By their new Act, the Bristol Gas Company are authorized to raise additional capital not exceeding in the whole £400,000 by the creation and issue of further nominal amounts of capital stock, with a dividend limited to 5 per cent. per annum; the issues to be subject to the new auction clauses. The amount the Company may raise on mortgage, and in respect of which they may create and issue debenture stock in accordance with the provisions of the Acts of 1891 and 1899, is increased by one-fourth part of the amount of the additional capital which at the time of borrowing has been raised under the provisions of this Act. The Company are given power to redeem or purchase, by agreement, any debenture stock issued under the powers of their Act of 1873; and to the extent of the nominal amount of any such redemption or purchase, their powers in regard to the creation and issue of debenture stock are to be deemed to be increased. The clause in the Act of 1873 relating to sulphur in the gas other than sulphuretted hydrogen is repealed. The Company have been granted a standard illuminating power of 14 candles, using the "Metropolitan" No. 2 burner. The conditions attaching to the testing have been somewhat modified since the Bill was noticed on Jan. 18 (p. 156). In reference to penalties, the results are confined to one day instead of three, in these terms: The illuminating power of the gas supplied by the Company on any one day shall be ascertained by taking the average of three consecutive testings of gas made on such day at intervals of not less than one hour; and the Company shall not be liable to any penalty or forfeiture unless such average illuminating power shall be less than the prescribed illuminating power. The limits of the Company are extended to the places specified in the Act. The clause as to the appointment of a Managing-Director as set out in the review of the Bill has been preserved in the Act. The Directors also take power to themselves to determine the salary of the Secretary. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The East Grinstead Gas and Water Company's Act (being mainly devoted to water supply) will be dealt with later among the water measures. It may be stated here, however, that the Company have procured the right to raise £40,000 additional capital, which is to be entitled to 7 per cent. dividend on the part issued as ordinary, and 6 per cent. on the preference. The new auction clauses will apply to the issue. Borrowing powers are allowed to the old extent of one-fourth. The Company are ordered to keep separate accounts as between the gas and water undertakings. A new testing place is to be provided in the offices of, or at a convenient place provided by, the District Council—this being in substitution of the testing-place defined in the Act of 1878. The Council are to provide at their own cost the building for the testing apparatus, and pay £50 towards the expense of the latter. [*Parliamentary Agents: Messrs. Rees and Freres.*]

The Exmouth Gas Company have secured the right to extend their limits of supply so as to include Lympstone and Woodbury. Additional lands are scheduled for manufacturing purposes. Provision has been made for the conversion and consolidation of all the existing preference shares into one class of preference stock to the amount of £12,200, and bearing a uniform interest of 5 per cent. per annum. The existing ordinary shares are also to be transformed into consolidated ordinary stock to the amount of £17,000, bearing 5 per cent. interest. Additional capital powers are granted to the extent of £24,000, of which not more than £16,000 may be raised as preference stock. The new auction clauses are to apply. Borrowing powers on the ordinary lines of one-third are allowed. With the change on conversion of capital in the standard rate of dividend, the sliding-scale provisions have undergone the usual modification. A special purposes fund has been arranged for. The standard illuminating power of the gas is to be 14 candles, tested by the "Metropolitan" No. 2 burner. The Company have secured a stand-by clause. The ordinary prepayment clauses appear. It is also provided that the Company are not to be liable to either penalty or forfeiture by reason of the presence in the gas supplied by them of sulphur compounds other than sulphuretted hydrogen. [*Parliamentary Agents: Messrs. Torr and Co.*]

Artificial Lighting of Rooms.—At a recent meeting of the Royal Society of South Africa, the subject of the influence of uniformity and contrast on the amount of light required for the illumination of apartments was brought forward by Mr. H. Bohle. According to an abstract of his paper in "Nature," the author dealt first with the adaptation of the human eye to various daylight illuminations, and gave a fresh definition of "glare." When the eye looks at an illuminant of great intrinsic brilliancy in front of a dark background, it tries to do two things at once—to open wide for the dark background, and to close up for the intrinsic brilliancy. The author then considered the physiological effects of radiation, explained overheating of the eyes due to excess light absorption, and considered the effects of the ultra-violet rays of modern illuminants and of solar radiation. In addition, he dealt with the destructive action of rays when applied excessively, and finally the effect which uniformity and the avoidance of contrast in artificial lighting have on the amount of light required. He came to the conclusion that in a room with black walls an illumination of 35 to 40 candle-metres is required; whereas in a place with white ceilings and light walls the amount of light can be reduced to 30 candle-metres. For perfect uniformity in such places, as obtained with inverted lamps, 20 candle-metres give, in the opinion of the author, complete satisfaction. The effects of various lampshades on the uniformity of illumination were also shown.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 55.)

THINGS on the Stock Exchange moved irregularly last week, but without any violent fluctuations. Adverse factors were the tightening of money, labour troubles, and the drop out in the Rubber Market, which occasioned anxiety regarding the settlement. The opening day was dull; the rise in the German Bank rate being the first warning note of possible trouble. Consols fell ¼; and all the chief markets were lower except the American. Tuesday was brighter. The beginning of the settlement gave fair promise of smoothness. Consols recovered ⅛; and the rest were not much changed except some of the old favourites in the speculative line. Wednesday was very quiet, and the general tendency was duller, in view of the monetary aspect. On Thursday, there was no increase of activity in business, but the tone was decidedly better; apprehension as to difficulties arising out of the settlement being pretty well allayed. Government Stocks were firm, Rails were quite strong with rising prices, and even the lines which had been showing persistent weakness cheered up. The improved feeling continued through Friday; and prices advanced moderately in almost every leading department. Saturday was very quiet; and the general tendency was hardly modified at all, though Rails were a little perturbed by the non-settlement in the labour market. In the Money Market, there was a good demand for the Stock Exchange and the turn of the quarter. Following the German lead, the Bank raised its rate of discount to 4 per cent. from the 3 per cent. rate fixed on the 9th of June. Business in the Gas Market was about on a level with that of the previous week in point of volume and of general strength; and several further advances in quotations were marked on both the London and the Provincial Exchanges. In Gaslight and Coke issues, the ordinary stock showed increased strength, with transactions ranging between 106¼ and 107—a rise of ¼. The secured issues were rather active; the maximum realizing from 87½ to 88¼, the preference 103¾ and 104¾, and the debenture 81¼ and 81⅝. South Metropolitan was very quiet and firm at from 121¾ to 122½. In Commercials, the 4 per cent. was steady at 107¾; but the debenture gave way a point at 79. Among the Suburban and Provincial groups, Alliance and Dublin marked 86½ (a rise of 3½), Brentford debenture 100, Ilford debenture 98¾ and 99¼, and South Suburban 121½. On the local Exchange, Liverpool "A" was done at 220 and ditto "B" at 163—a rise of ½. In the Continental companies, Imperial was stronger, changing hands at from 187¼ to 188¾ (a rise of 1), Union was done at 97 (a fall of 1), European fully-paid at from 23¾ to 24, ditto part-paid at 18, and Tuscan at 9⅜. Among the undertakings of the remoter world, Buenos Ayres debenture was dealt in at 97½, Oriental at 139, Primitiva at from 7¼ to 7⅜, ditto preference at $5\frac{5}{8}$ to $5\frac{5}{16}$, and ditto debenture at 97½.

ELECTRICITY SUPPLY MEMORANDA.

Principles and Charges—The Honesty of the "Electrician"—More Arithmetical Evolution—Rival Claims—A Link with the Past—All through the Metallic Filament—Olympia Again.

A FORTNIGHT since, an article appeared in our editorial columns on "The Relations of Municipal Gas and Electricity Departments," in which special reference was made to Manchester. For Mr. Pearce, the Chief Engineer of the Manchester Corporation Electricity Department, we have the greatest respect and admiration; and therefore the more heartily do we welcome the letter that appears from him in our "Correspondence" column, as to the general principles governing—or said to govern—charges for electricity supply. The statement of these principles as submitted by our correspondent has been encountered by us times out of number through a somewhat natural inclination of interest in the affairs of the electricity industry. But though we try, in quest of knowledge and in the desire to be just, to divest our minds of bias in examining these principles, they always appear, the further penetration goes, to be usefully employed in covering a multitude of sins—in other words, the principles are often found to be as much honoured in their breach as in their observance, and to be subordinated to the exigencies of a business open to the keenest of competition. We quite agree that the chief expenses of an electricity undertaking are due to the necessity of being in readiness to supply, and also that the total costs are bound to vary according as the hours of demand are long or short; and we also admit the usefulness of a diversity of demand on an undertaking. Thus Mr. Pearce will see that, on the question of general principles, there is no real difference between us.

But now applying these principles, we have never seen, so far as remembered, an analysis offered by a station engineer of actual charges to prove that justification bridges the prices from the two extremes. The extent of the variation is our trouble, and not the principle of differential charges for different purposes and for volume and duration of demand. It is not readily seen that "there is ample warrant for the wide disparity between the charges for electric lighting and electric power supplies, or, to write more correctly, between short-hour and long-hour consumers." We will not take the extreme Manchester price of 0·7d. per unit for power, but the top power price of 1·5d. We submit that, if Mr. Pearce now searches his accounts, he will probably find several power patrons paying this price whose consumption, quantitatively and measured by hours of demand, has correspondence with that of many of the lighting consumers who are paying on the flat-rate of 3·75d. What we want to know is why, in the circumstance of equality, there should be this great difference of 2·25d. between two consumers. Again the use of electricity for cooking is a short-hour use; and we should like to be informed, applying the principles named by Mr. Pearce, of any justification there is for charging (we are not sure the figure is correct) 1½d. per unit for this short-hour custom as compared with the longer hours of the lighting consumer paying 3¾d. Mr. Pearce has perhaps studied the curves of gas undertakings in largely residential localities; and, if so, he will know that, during the short period of a couple of hours on Sunday while preparations are proceeding for dinner, the demand on the gas-works takes a flight upwards and downwards in a most precipitate fashion. That would come under the category of a short-hour demand, and per consumer it is a very small demand. Supposing this load were placed on the electricity undertaking, what justification would there be, under the principles stated by Mr. Pearce, for charging the current used at (say) 1½d. per unit, while the same consumer may be using electricity for lighting for several hours constantly night after night at 3¾d.? In other words, he is called upon to pay three times more for his long-hour lighting load than for his short-hour cooking load. We are not disputing principles, but are merely marvelling at the flexibility shown in electricity charges by the application of the principles, or, would it be more correct to say, want of application? Of course, it is quite agreed that the power of storage possessed by gas undertakings is something over which central station electricity engineers have cause for envy.

Stimulated by the article that appeared in the "JOURNAL" as far back as Sept. 6, headed "A False Foundation," the "Electrician," after obviously spending many laborious hours, with the aid of a number of hypotheses, published on Sept. 23 an article purporting to give the last word on the question of the Gaslight Company's costs in relation to the Westminster public lighting contract. In our previous article, we corrected certain figures put forward by our contemporary and Mr. E. W. Seale regarding the gas consumption of the new high-pressure inverted lamps, as well as their absurd estimates as to the price the Gaslight and Coke Company are charging for the gas consumed by these lamps. The "Electrician," save in one respect, is as delighted as a child with a new plaything over the figures published in our article. We are pleased. "At last our gas friends have forsaken some of their vagueness, and have actually descended into figures." But we have never "descended" so low into figures that at any time we have reached 5½d. per 1000 cubic feet as the figure at which the Gaslight Company are charging out the gas consumption of the Westminster high-pressure lamps. It was a stupid calculation; and there was no excuse for anyone making it who possessed even an elementary knowledge (perhaps our contemporary does not do so) of gas affairs, and was not behind the times respecting the progress of gas lighting. But after the error was pointed out, our contemporary coolly reiterated it; and we called this dishonest on their part. The "Electrician" also took the efficiency of the old vertical burner high-pressure lamp in forming a foundation for its computations, instead of the new high-pressure inverted burner lamp. Its attention was called to the error—if so it can be termed, seeing the amount of publicity that had been given to the remarkable efficiency achieved by new invention in high-pressure lamps. But our contemporary repeated the statement. That we called dishonest. And the "Electrician" feels aggrieved over the epithet—suggesting that it was scarcely necessary for us to use such a term. We do not withdraw it, but emphatically reassert that the repetition of statements of the kind, unless done in ignorance, is not honest, and, if ignorance on the part of an electrical writer is at the bottom of such a performance, then it is inexcusable.

Our contemporary is still burning to show that the Gaslight and Coke Company have entered upon an unprofitable business in this Westminster street lighting. It takes the figure with which we presented it as to the consumption of a 3000-candle high-pressure gas-lamp. But the figure is not quite what the "Electrician" wanted; and so (we do not know why, unless it is to swell the costs), it feeds each of the lamps with 10 per cent. more gas than it requires—the declared reason being that this extra supply will be necessary to comply with the conditions of the contract. Who on earth has been putting that queer notion into the head of our electrical contemporary? The Company will see that the pressure at which the gas is supplied will in all parts of the district prevail upon the lamps to give their full efficiency. The writer of the article, too, has at length grasped some idea as to the net manufacturing cost of gas into the holders per 1000 cubic feet (including 3·87d. charged for renewals and repairs over the whole of the manufacturing plant, it works out to rather less than 1s. per 1000 cubic feet); but he jumps about in a most sprightly fashion in the attempt to fix upon some figure that he can take hold of in his anxiety to show that the Gas Company are not making a profit on the transaction. Then he goes on to take various other hypothetical figures to make up a total, which gives his uneasy mind "at least just cause for suspicion that the margin of profit is negligibly small, if not negative." This is somewhat different from the former conclusion; and so we may let our friend rest in the happiness of his suspicion. To say the least, it is not very profitable to indulge in arithmetical evolutions of this kind. Our

contemporary has already been impaled through its penchant for such exercises. There is, however, pleasure on our part that two or three authoritative figures have now convinced it that the Gaslight Company are not quite so foolish as the first calculations endeavoured to make out.

It ought perhaps to be also mentioned that the "Electrician" desire their view to be known that their gas friends have "no right to claim, as a result of these contracts, that street lighting by gas is cheaper than electricity." Of course, it does not know of any electricity undertaking in London charging pence per unit to the private consumers for electricity for lighting, and only 1d., or about 1d., per unit for current consumed in the street lamps. Naturally, not being of a very combative temperament, we do not desire to make much of this. But what we do wish to emphasize is that our contemporary has no right to claim, as a result of this, that lighting by electricity is cheaper than lighting by gas. Does it not see that if for street lighting it is necessary to come down to such a fine price for electricity in order to compete with the inverted gas-lamp, then the private electricity consumer who has to pay 4d., 5d., or 6d. per unit must be paying very heavily for illumination? Sorry. There is one more point. Will our contemporary favour us by reading the first three paragraphs of the "Memoranda" in the "Journal" for Sept. 13. It will prevent a repetition notice here as to Marylebone public lighting "savings."

"George Offor!" The name recalls the early days of electricity supply in this country. This gentleman was mixed up with the infantile years of certain concerns. The name now serves as a sort of link with the past. George Offor, electrically speaking, still lives in the past; and he apparently requires a lot of modernizing to put him on a level with things as they are. We have before remarked that the "Electrical Review" loves the antique even in electric lighting testimonials. It loves George Offor, and has allowed him to indulge himself to the extent of a couple of columns, mostly devoted to the reproduction of testimonials which must have required a good deal of dusting before the reminiscent Mr. Offor could send them to the editors for publication. The testimonials are expressive of the satisfaction of electric lighting users with the favourable charges compared with gas. They are dated 1884, 1894, 1902. These dates are enough to make the old flat-flame burner rise up in dignified protest over this reminder of its inefficiency. We wonder whether George Offor has heard of inverted incandescent gas-burners giving up to 30 candles per cubic foot of gas consumed at ordinary district pressures, and 60 candles at high pressures. The columns of a technical paper might be filled with something possessing a little more freshness about it than is supplied by this survivor of the mediæval times of artificial lighting.

There has been surprise and protest over the decision of the Metropolitan Electric Supply Company to increase the flat-rate for current from 5½d. to 6d. per unit; the lessened consumption of consumers using the metallic filament lamps being blamed for the necessity for taking the step. The Company's administration are charged with walking backwards. The act at any rate shows this, that the Company have not been able by new lighting business to pick up the losses occasioned by the metallic filament lamp, though no doubt they have made a struggle to do so, seeing that the metallic filament lamp has been with us some time, and this increase has only just been determined upon. But the Company are at the same time adopting the "telephone" system of charging—a fixed quarterly payment, with a specified number of units charged at 2d., and all consumed after (during the quarter) at 1d. Between the two systems, perhaps the Company will have less ground for fear. Naturally, we wish them well.

It has generally been the electricity industry that in exhibition work has followed the gas industry. But it is determined to be first with the next big display in London; and there will therefore, we understand, be occupation of Olympia by electricity during September, 1911.

THE BURKHEISER PURIFYING PROCESS.

In the "Journal" for the 2nd of November last (p. 311), a description appeared of the principal features of the Burkheiser process of purifying gases; and in the same number of the "Journal" (p. 326) an abstract was given of the specification of the patent by which the process is protected. A detailed description of the process is communicated by Dr. W. Bertelsmann to the "Chemiker-Zeitung" of the 20th ult.; and as it appears therefrom that some modifications have been introduced with a view to improve the process since the description of it was given in our pages, a few further details may be quoted with advantage from Dr. Bertelsmann's article.

It is first pointed out that in the dry distillation of coal, from 10 to 50 per cent. and upwards of the sulphur contained in the coal, amounting to 0·5 to 4 per cent. of the latter, goes into the volatile products. Consequently, the crude gas may contain as much as 3·12 lbs. of sulphur per 1000 cubic feet of gas, or nearly 2200 grains of sulphur per 100 cubic feet. Of this sulphur, from 94 to 97 per cent. is in the form of sulphuretted hydrogen, and the remainder in the forms of carbon bisulphide or aliphatic and aromatic sulphur compounds. During the condensation and washing of the gas, about 25 per cent. of the sulphur is taken out; and, where cyanogen is recovered by washing with solution of sulphate of iron, a further 5 per cent. is removed. The condensed and washed gas may therefore contain 70 per cent. of the sulphur in the crude gas, or at the most, about 2·18 lbs. per 1000 cubic feet. This sulphur, so far as it is in the form of sulphuretted hydrogen, is ordinarily removed from the gas by treating it with moist ferric hydrate. The action of sulphuretted hydrogen on ferric hydrate, according to the equation

$$Fe_2(OH)_6 + 3H_2S = 2FeS + S + 6H_2O$$

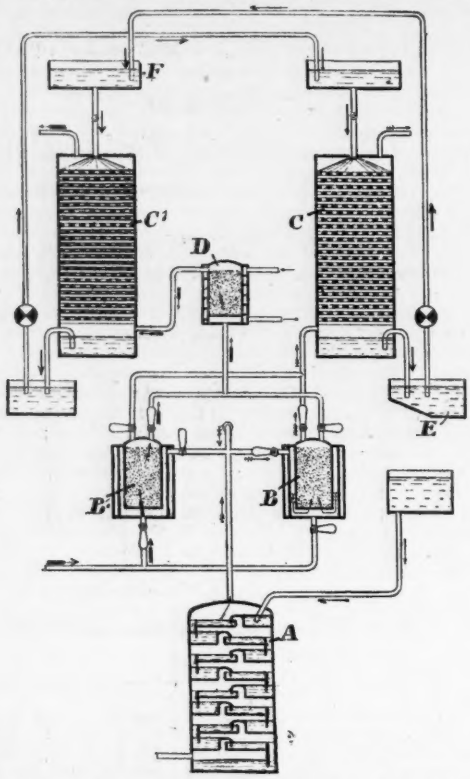
is attended by the evolution of 25 B.Th.U. per cubic foot of sulphuretted hydrogen. The oxidation of the moist sulphide of iron by the air liberates 243 B.Th.U. for the quantity of sulphide of iron corresponding to 1 cubic foot of sulphuretted hydrogen. The oxidized or revivified material is again available for the absorption of sulphuretted hydrogen; and ordinarily the absorption and revivification go on together by the addition of about 1½ per cent. of air to the gas which is to be purified.

Dr. Bertelsmann points out that the ordinary process of purification of gas by means of oxide, as described, requires the use of iron vessels of large area, and generally of large concrete revivifying floors. He states that the spent oxide containing about 50 per cent. of sulphur is almost valueless as a raw material for the manufacture of sulphur or sulphuric acid, and is valuable only on account of the cyanogen which it contains. Hence the removal of sulphur from gas does not afford a valuable bye-product, but entails considerable expenditure. He mentions some previous attempts to combine the sulphur in a convenient manner, so as to make it of value, but passes them over because so far it has not been reported that good results have been obtained from them. He then refers to the Burkheiser process as described in the "Journal," pointing out that the process embodies the following series of operations: (1) The absorption of sulphuretted hydrogen by means of purifying material; (2) the revivification of the fouled purifying material, with formation of sulphur dioxide; (3) the formation of ammonium bisulphite from the sulphur dioxide and a solution of ammonium sulphite; (4) the formation of ammonium sulphite by the taking up of ammonia by the solution of ammonium bisulphite; and (5) the oxidation of the ammonium sulphite to ammonium sulphate. As stated in the previous article, the absorption of the sulphuretted hydrogen is accomplished by means of artificial or natural ferric hydrate; but Burkheiser heats this material to a temperature above 100° C., whereby it loses a part of its water by hydration, and passes into a lower hydrate—probably Fe_2O_3,H_2O. Any organic material present is at the same time burnt, and the prepared material is of a deep red colour and very porous. It is used in purifiers in a dry state to a depth of 6 to 10 feet, and is said to be capable of purifying 20,000 times its volume of gas before requiring revivification. The absorption is facilitated by previous warming of the gas by means of waste heat; and the deposition of any water in the purifying material is thereby avoided. The fouled material is revivified in the purifying vessel by means of a blast of air, but in such a manner that the oxidation takes place so vigorously that sulphur dioxide is formed at once, and passes out of the vessel with the nitrogen of the air. The heat thus liberated is partly utilized for the preliminary warming of the crude gas. The sulphuric acid and sulphates of iron produced are removed at the close by washing the purifying material, which is subsequently dried in a current of air, and thus rendered fit for use again.

The ammonia in the gas is extracted by washing, and the resulting liquor is used for washing the air containing sulphur dioxide, which is thereby combined to form ammonium sulphite and ammonium bisulphite. The solution of ammonium bisulphite then serves for washing the gas; and, by taking up ammonia, it is converted into the neutral solution. The solution thus makes a continuous circuit—passing from neutral to acid and from the latter to the neutral state again. The salt with which it gradually becomes strongly impregnated is precipitated. It consists, owing to oxidation, of about 60 per cent. of sulphate and only 40 per cent. of sulphite; and, while in this state it would be quite suitable for manurial purposes, it is, in order to meet the views of purchasers, completely converted by oxidation into sulphate through sublimation of the sulphite and oxidation of the sublimed material. It is easy, by oxidation in the air, to convert about two-thirds of the sulphite to sulphate, and hence by sublimation and oxidation a sulphate free from sulphite is produced.

Dr. Bertelsmann next describes the apparatus for the practical carrying out of Burkheiser's process. It is substantially identical with that described and illustrated in the "Journal" for the 2nd of November last. He refers also to a special apparatus or oven with a continuous conveying screw for the treatment of the oxidized fouled oxide for the extraction therefrom of the sulphate and sulphite; but it appears from a later statement that the use of this apparatus is discarded under an improvement of the process which Herr Burkheiser has since made. An attempt to recover the cyanogen in the gas along with the ammonia, by converting it into ammonia, through the intermediate formation of ammonium sulphocyanide, has not yet attained practical success. So far Burkheiser's process has only been successfully adopted in large experimental installations, and final judgment on it must be withheld until it has been tried for a sufficiently long time on a large working scale. Its objects are to economize the space required for purifying plant, and to cheapen the cost of that plant while effecting economies in purifying material, wages, and sulphuric acid.

A modification of the process, which is also protected in Germany by a patent, aims at producing sulphate directly and exclusively. The sulphur dioxide formed according to the original process is passed, along with excess of air, over heated contact material, whereby it is oxidized to sulphur trioxide. Thus the modification combines Burkheiser's original process with the contact process for the manufacture of sulphuric acid. The original apparatus is supplemented by the provision of a contact chamber which takes the place of the oven with conveying screw already referred to. The gas freed from tar mixes with ammonia evolved from a distilling column A, and passes with it into a heated purifier B, from which the gas thereby freed from sulphuretted hydrogen goes on to a washer C in which it is freed from ammonia. Air is



meantime blown into another purifier B¹, already fouled with sulphur, and oxidizes the sulphide of iron with formation of sulphur dioxide. The latter passes into the chamber D, which contains platinized asbestos, ferric oxide, or other contact material, and is heated by superheated steam or waste gases to the necessary temperature for the reaction, which, with ferric oxide, is about 600° C. The sulphur dioxide is thus converted into sulphuric anhydride, which is washed out from the residual nitrogen in a washer C¹. The solution thus produced is used to wash the gas for the extraction of ammonia, and the sulphate formed is removed from the vessel E as the liquid becomes saturated with it, while the neutral mother-liquor is pumped to the tank F, and again used in the tower C¹ for the absorption of sulphuric acid.

Herr Burkheiser proposes by another patented process to convert in the ordinary way one-third of the sulphuretted hydrogen of the gas into sulphur dioxide, and cause this to react with the rest of the sulphuretted hydrogen, according to the equation—

$$2H_2S + SO_2 = 2H_2O + 3S.$$

This proposal, however, does not provide for the utilization of the sulphur, and does not combine ammonia recovery with sulphur purification.

PERSONAL.

Mr. JOHN F. WEST, formerly Manager of the Stockport Corporation Gas Department, has, out of 67 applicants, been appointed Outside Superintendent of the Department.

Mr. F. H. BRUNT, Engineering Assistant to the Manchester Corporation, has, out of 91 applicants, been appointed Manager of the Rochdale Corporation Water-Works, in succession to Mr. W. Tomlinson, who is retiring after 40 years' service. Mr. Brunt, who is 37 years of age, was educated at the Manchester Municipal School of Technology, where he is now Lecturer on land and engineering surveying. The commencing salary of his new post is £250 per annum, rising to £350.

Mr. JOHN PHILLIPS, who has been for half-a-century in the service of the Bristol Gas Company, and has for many years held the post of Secretary, has been elected to a seat on the Board. He will, however, retain the secretaryship by virtue of the special provision in the Company's last Act of Parliament to which attention is called to-day in our second article (p. 21) dealing with the Gas Acts of the present session. We heartily congratulate Mr. Phillips on this recognition of his long and devoted service to the Company.

Many of our readers, especially those who have had business transactions with the Phœnix Iron-Works at Stroud, will be interested to learn that Mr. and Mrs. GEORGE WALLER celebrated their golden wedding on Monday last week. Besides the family gathering, they were invited to meet the employees at the works, when Mrs. Waller was presented with a gold and diamond brooch, Mr. Waller with a gold-mounted walking-stick, and jointly with a silver rose-bowl, suitably inscribed. On Wednesday, Mr. Waller entertained the workmen, staff, and representatives at supper, which was followed by a musical evening.

OBITUARY.

Mr. WILLIAM LISTER, J.P., and Mayor of Stockport in 1902, who died last Tuesday, aged 65, was elected a member of the Town Council in 1889, was made an alderman in 1901, and for some time was Chairman of the Gas Committee.

It is reported that Hofrat Dr. HEINRICH CARO, a member of the Board of Directors of, and formerly Manager of, the Badische Anilin und Soda Fabrik, at Ludwigshafen-on-the-Rhine, died at Mannheim on Sept. 11. He had attained his seventy-seventh year. He was one of the pioneers of the coal-tar colour industry, of which he gained his early experience in England, and on returning to Germany was recognized for upwards of fifty years as a leader in this branch of applied chemistry. He took an active part, also, in formulating the German patent laws. His services to industry were acknowledged by his being made the recipient of many honorary degrees and distinctions, among which may be mentioned honorary membership of the Association of German Engineers and of the Association of German Chemists.

We regret to learn that the Directors of the Colonial Gas Association have lately lost an esteemed colleague in the person of Mr. A. GODWIN HAMMACK. The name of Hammack has been on the roll of the Association since it was started in 1888; the father of the deceased having been the first Chairman. In October, 1894, he was succeeded on the Board by his son. Shortly after the last annual meeting in November, Mr. Godwin Hammack had a paralytic seizure, in consequence of which he was unable to follow his profession as a Solicitor or attend any meetings of the Board. A few months ago, some hope was entertained of his recovery; but he had a relapse, to which he succumbed at his residence at Littlehampton. He was also one of the Directors of Messrs. William Sugg and Co., Limited, in which position he succeeded his father.

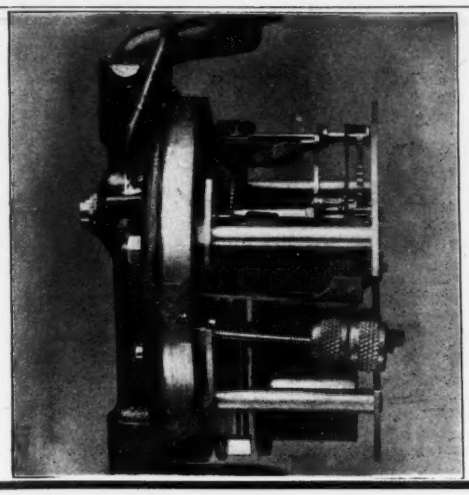
HOW TO TRADE SUCCESSFULLY.

By R. W. EDWARDS, of Aldershot.

ABOUT two-and-a-half years ago the question of rebates presented itself, owing to the difficulty in attracting consumers in our out-districts to adopt gas more extensively for cooking and heating. In the home district the question did not apply so acutely, because the ordinary price was a flat-rate of 2s. 6d., then sufficiently attractive to bring a steady flow of orders for cookers and fires in their respective seasons.

It should be pointed out that the Company's area covers nearly 100,000 acres, embracing twenty-eight parishes. The prices in the various groups are not identical, but are governed by Acts in which the principle is followed of graduating the rate according to the distance from our home district. Though not so worded, it was intended that in the first set of out-districts the price charged should never be more than so much above the home rate; and it was stipulated that for a period of years the excess price under this arrangement should not be less than so much—the latter point being designed to protect the home area. Subsequent powers fixed a higher maximum difference, with a fixed minimum again for a series of years; and this was on the presumption that the first batch of out-districts was nearer to the works than the area added later. Hence the higher maximum difference. The actual figures are purposely omitted, principally because they are but incidental to the question under review, and the reference is only intended to enable readers to appreciate why one thought of differential rates. There was no getting away from the fact that our higher rates in the outside areas (although lower than, or quite as low as, the general prices charged by other Southern companies) did not tend to develop our sales in the direction of consumption for fuel, &c.

After realizing the fact that differential prices would go a long way to solve the problem, the next difficulty which presented itself was that of registration. It was practically impossible to suggest the use of separate meters for each fire or cooker, or the separation of pipes in existing houses. Experiments were then made over several months with a few hundred rotary meters—utilizing them only for arriving at the amount of rebate, and not as a basis of account. "Rebate Indicator" is our name attached to these little instruments; and each is carefully tested on arrival from the makers, and before being issued for fixing in the various districts.



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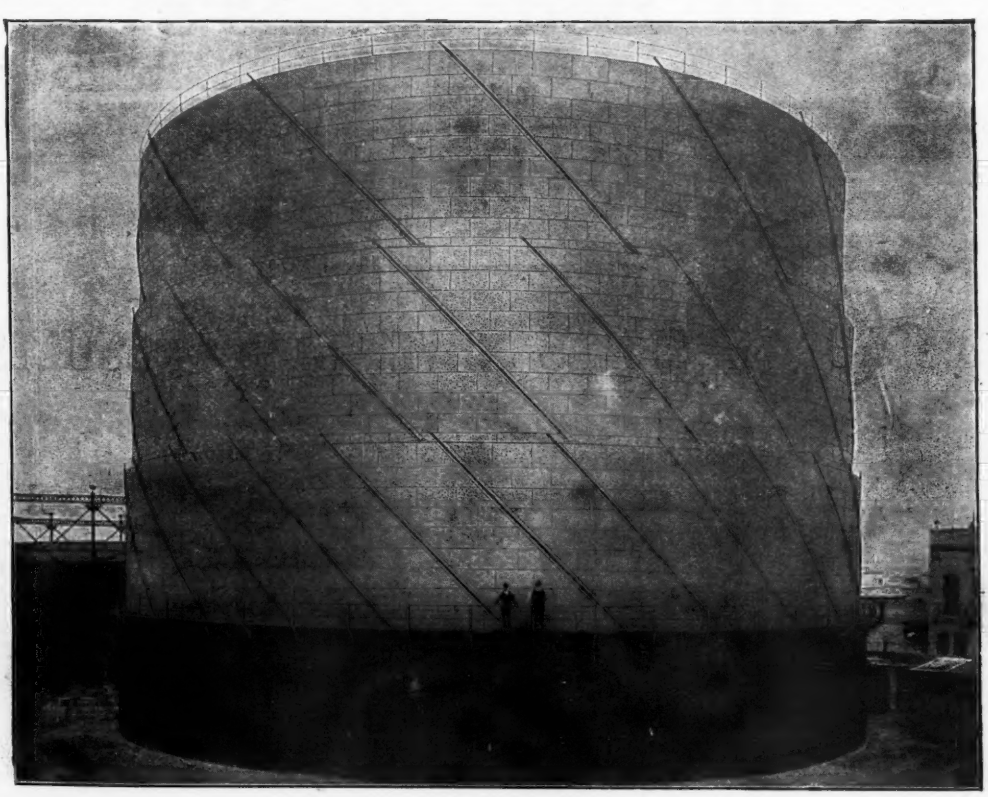

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Ultimately, it was demonstrated that the principle of offering a rebate was a right one; and about two years ago the system was generally adopted in the out-districts.

In offering the rebate (6d. per 1000 cubic feet) off gas registered separately for cooking and heating, the consumer taking advantage of it was invited to enter into a short agreement embodying the following:—

The total consumption of gas will, as hitherto, be registered by the meter, and of that the quantity used for cooking and heating will be ascertained by the Company by means of an indicator (about the size of a very small clock) which will be fixed by and at such point or points of the consumer's internal pipes as the Company select.

A small rental of 6d. per quarter will be charged to the consumer in respect of each indicator, in addition to the usual meter-rent, which, of course, varies with the capacity of the meter. And the rebate will be subject to the following further conditions:—

1. **Punctual payment of accounts—that is, payment of the whole of the last quarter's account due to the Company must be made on or before the last day of the month subsequent to that in which falls the quarter-day ending the period of consumption to which the account refers—viz., on or before Jan. 31 for the quarter ended Christmas; on or before April 30 for the quarter ended Lady-day; on or before July 31 for the quarter ended Midsummer-day; and on or before Oct. 31 for the quarter ended Michaelmas.**
2. **Should payment of the whole of the amount due to the Company in respect of any quarter not be made strictly in accordance with the conditions laid down in the preceding clause (clause 1) the price to be paid by the consumer for gas consumed for cooking, heating, or motive power purposes will be the net price, and the rebate will not be allowed.**
3. **The Company reserves the right to discontinue allowing the rebate at any time, on giving the consumer one quarter's notice.**

The agreement renders an important service, as it stipulates as a *sine quâ non*, the settlement of the account by a given date; otherwise the rebate is forfeited. The stipulation is not harsh; and although occasional instances happen of consumers overlooking the date, where such omission is of an isolated nature in a particular case, and a reasonable explanation is forthcoming, the rebate is allowed. If the system was inelastic, some irritation would be caused and more harm than good done by the arrangement. Tact and reasonable consideration in matters of this kind must dominate in all business—that is if one wishes to cultivate the consumers' good-will, and advance the interests of the undertaking.

After two years or so, what was commenced as an experiment, in spite of many warnings from well-meaning friends, is now a successful and established arrangement. Our consumers thoroughly appreciate the system which enables them to utilize gas for purposes other than lighting, at a reduced cost.

Briefly, the following are some instances taken at random from our ordinary rentals, showing the comparative consumptions before and after the operation of the rebate. Consumers' names are not given.

Annual Consumption.	
Consumer A.—Four gas-fires.	
Year before rebate operated	31,800
,, after ,, ,,	79,700
Increase	47,900
At rate of (per cent.).	150·6
Consumer B.—Three gas-fires.	
Year before rebate operated	50,000
,, after ,, ,,	77,900
Increase	27,900
At rate of (per cent.).	55·8
Consumer C.—Three gas-fires.	
Year before rebate operated	42,100
,, after ,, ,,	96,400
Increase	54,300
At rate of (per cent.).	128·9
Consumer D.—One fire.	
Year before rebate operated	92,400
,, after ,, ,,	131,700
Increase	39,300
At rate of (per cent.).	42·5
Consumer E.—One cooker (small hotel).	
Year before rebate operated	16,800
,, after ,, ,,	57,800
Increase	41,000
At rate of (per cent.).	244
Consumer F.—Fourteen fires.	
Year before rebate operated	399,200
,, after ,, ,,	495,600
Increase	96,400
At rate of (per cent.).	24·1

Annual Consumption.	
Consumer G.—One cooker.	
Year before rebate operated	135,300
,, after ,, ,,	184,300
Increase	49,000
At rate of (per cent.).	36·2
Consumer H.—One cooker.	
Year before rebate operated	20,100
,, after ,, ,,	35,400
Increase	15,300
At rate of (per cent.).	76·1
Consumer I.—Two fires.	
Year before rebate operated	46,500
,, after ,, ,,	76,700
Increase	30,200
At rate of (per cent.).	64·9
Consumer J.—One cooker.	
Year before rebate operated	27,000
,, after ,, ,,	51,000
Increase	24,000
At rate of (per cent.).	88·8
Consumer K.—Two fires.	
Year before rebate operated	54,400
,, after ,, ,,	73,500
Increase	19,100
At rate of (per cent.).	35·1
Consumer L.—Two fires.	
Year before rebate operated	38,000
,, after ,, ,,	57,500
Increase	19,500
At rate of (per cent.).	51·3

Excepting E, all are private consumers, of a class difficult to approach; and unless one has something really attractive to negotiate with, there is little hope of a canvasser even getting an interview.

One cannot yet claim to have passed the experimental stage; and it is questionable if one ever does. Nowadays, it is imperative that consumers should have an ever-varying attraction; otherwise they are unlikely to even notice one's claim, however honest and worthy it be. The general results reflected in the consumptions of the twelve ordinary consumers must appeal to all, and demonstrate what business still remains to be obtained—showing, apart from the cooker field (which is becoming saturated in many towns), what a vast territory there is yet to be developed by pushing the sale of gas for heating. Where electrical competition is fierce, they indicate how much lost ground can be recovered by a proper method of selling.

In these days of political discussion of the principles of how to trade, one can take a profitable lesson by learning the true meaning of "negotiate." I have in my mind schemes for the future which I trust will equal the rebate system outlined in this article; but the introduction must be governed by circumstances. The slot consumer has not been neglected. The system has been extended in the same districts to that class of customers. The difference is that we find the slot consumer has, so far, not taken up the gas-fire to the same extent as has the ordinary consumer. The following are some random cases:—

Annual Consumption.	
Consumer A.—One cooker (private house).	
Year before rebate operated	21,200
,, after ,, ,,	39,000
Increase	17,800
At rate of (per cent.).	83·9
Consumer B.—One cooker (let apartments).	
Year before rebate operated	57,100
,, after ,, ,,	69,800
Increase	12,800
At rate of (per cent.).	22·4
Consumer C.—One fire (private house).	
Year before rebate operated	12,200
,, after ,, ,,	17,200
Increase	5,000
At rate of (per cent.).	40·9
Consumer D.—One cooker (let apartments).	
Year before rebate operated	80,300
,, after ,, ,,	88,000
Increase	7,700
At rate of (per cent.).	9·5
Consumer E.—One cooker and three fires (private house).	
Year before rebate operated	41,900
,, after ,, ,,	118,200
Increase	76,300
At rate of (per cent.).	182·1
Consumer F.—One cooker (let apartments).	
Year before rebate operated	16,600
,, after ,, ,,	24,100
Increase	7,500
At rate of (per cent.).	45·1
Consumer G.—One cooker (fish frying shop).	
Year before rebate operated	65,300
,, after ,, ,,	76,900
Increase	11,600
At rate of (per cent.).	17·7

Annual Consumption.	
Consumer H.—One cooker (private house).	
Year before rebate operated	21,900
,, after ,, ,,	25,600
Increase	3,700
At rate of (per cent.).	16·8
Consumer I.—One cooker (butcher).	
Year before rebate operated	17,300
,, after ,, ,,	20,700
Increase	3,400
At rate of (per cent.).	19·6
Consumer J.—One cooker (private house).	
Year before rebate operated	14,300
,, after ,, ,,	28,800
Increase	14,500
At rate of (per cent.).	101·3
Consumer K.—One cooker (private house).	
Year before rebate operated	17,400
,, after ,, ,,	32,000
Increase	14,600
At rate of (per cent.).	83·9
Consumer L.—One cooker (private house).	
Year before rebate operated	19,900
,, after ,, ,,	28,000
Increase	8,100
At rate of (per cent.).	40·7
Consumer M.—One cooker (private house).	
Year before rebate operated	6,500
,, after ,, ,,	7,300
Increase	800
At rate of (per cent.).	12·3

The slot consumer's average consumption can be improved considerably by offering him a lower figure for cooking and heating. Though we allow a large free cooker to each slot consumer, the rebate only applies when the consumer desires a still larger (double-cased) cooker, for which a low nominal rent is charged. The consumer realizes that at the end of a quarter, if he uses gas for cooking or heating, there is something to come back. Not only has he no difficulty in paying the small rental for the special hire cooker, but he has something in hand.

It would serve no good purpose to take up space by dilating further on this system of differential rates. It is proved by our short experience that the idea is a perfectly sound one, and capable of being widely extended, to the advantage of the consumer and the gas authority.

The ordinary consumer, at present offers the widest scope for the fire; and I am quite sure that if those companies who are working under a sliding-scale will look at the question unselfishly, it will be found that, instead of reducing the general price without getting anything like a reasonable response in increased consumption, it would be better to give rebates to encourage

consumption in those fields that are yet scarcely developed. Meanwhile, it may not result in increased dividends; but it enables one to broaden the base of business, and in the long run so develop the sales as to bring about general economy by virtue of greater all-round use of plant and mains—ultimately securing a more all-day, all-the-year-round gas consumption, which, while keeping our competitors off this untouched and practically virgin heating field, will prepare our industry to better combat perhaps in times of more stringent competition, the claims for lighting. At present, a reasonable price for lighting holds its own trebly—at least as against electricity at 3d. But in time to come, when the metallic filament lamp has become more popular and cheaper, when electric stations have recovered from the set-back due to loss of consumption following the use of economical lamps, then the price for current will undoubtedly be cheapened; and when that time arrives the gas industry must be ready, and more than ready, with all the resources at its command, to successfully defend itself and attack its competitors. But unless one has a sound, well-constructed undertaking, on a broad basis, cheap in capital, economical and efficient at works, enterprising and up-to-date outside, with a business not confined to one or two channels, one cannot "play the game" successfully.

AUTOMATICALLY LIGHTING STREET-LAMPS.

[Communicated.]

For a great number of years past, the automatic lighting of street-lamps has been a problem that has occupied the attention of inventive minds in the gas industry. The problem would be much less complex than it is if the pressure conditions of one gas-works were the same as those of all others; but it may be safely said that no two gas-works have entirely the same conditions in this respect. Some attempts have been made to solve the problem by the use of electricity, by running an electric cable from lamp-post to lamp-post, whereby an electric current would operate certain mechanism to turn on the gas and give the necessary spark to light it. But the capital outlay for this process was prohibitive. Then, again, separate mains have even been thought of, and, as the writer thinks, tried. But here also the cost was prohibitive; and the result, apart from the cost, was a failure. The greater number of inventions have used the gas pressure itself as the motive power; but these have hitherto been so limited in their action that gas engineers have turned in despair to clock controllers. So that inventions for lighting street gas-lamps have ranged themselves into two classes: The pressure lamp-lighter and the clock controller.

The Clock Controller.

Taking the latter class first, it may be said that the inventions have not been entirely successful. The difficulty has been to get the controllers to keep correct time on account of using the time-keeping mechanism to turn the plug of a tap, which is sometimes stiffer than at others, and thus makes correct time-keeping impossible. It is a serious disadvantage that one lamp should be lit half-an-hour, or even longer, before the next one. The saving of gas in such case becomes a negligible quantity. Then the apparatus has to be wound every week, and the time for operating altered; and though it may be said that this can be done by the lamp cleaner on his rounds, still it requires doing, and the task of winding and regulating a thousand clocks 52 times a year is no light one. Besides, a lamp cleaner is not always qualified to handle delicate clock mechanism; hence the number of repairs. More than one make of clock controller regulates itself, automatically altering the times for lighting and extinguishing every four or five days; but the writer must confess that he does not see very much advantage in this, when the clock has to be wound every week. It might as well be adjusted at the same time as the winding. In one gas-controller, it took so long to turn on the gas that it frequently lit-back in the bunsen. In most other controllers, the other extreme is reached—the gas being turned on instantaneously. But this necessitates a permanent pilot flame.

Pilot Flames.

By "permanent" is meant one burning 24 hours a day. This is a very important matter, and one that does not receive the attention it deserves from those interested in public street lighting. Theoretically it is supposed that a pilot flame need not burn more than one-tenth of a cubic foot of gas per hour. This may be so, when the pilots are properly adjusted; but how often is this the case in actual practice? Under existing service conditions, it will be found that from one-fourth to one-third of a cubic foot of gas is consumed by the pilot per hour—in the one case 8 and in the other 6 cubic feet per day, or respectively 2920 and 2190 cubic feet per lamp per annum. In the use of an alternate pilot flame, which is extinguished when the burner flame is lit, nearly one-half of these quantities is saved. Taking the mean of the figures and the average number of hours for lighting, upwards of 1170 cubic feet are saved per lamp per annum.

Torch Lighting.

Some gas engineers, appreciating this saving, have adopted torch lighting; but the drawback is that in winter time the atmosphere in the lantern during the day is cold and damp, which seriously affects and shortens the life of the mantles. Again, the permanent pilot flame is apt to blacken the mantles with a deposition of carbon, because when the pilot is inside the mantle, the burner flame causes it to impinge on the surface. To overcome this trouble, a bunsen pilot flame has been invented. But surely the best remedy is to turn this flame out when the burner flame is lit. Here, again, trouble arises, because usually, in almost every lamp controller, the gas is turned on or off practically instantaneously. What happens is this: When the burner gas is turned on and the pilot gas turned off in the process of lighting, during the hours the burner gas is lit the gas contained in the pilot tube, between the tap or valve and the tip of the tube, being lighter than air, escapes, and its place is taken probably by the products of combustion, which are heavier than air. Hence, when the gas is turned off quickly there is no time allowed for the hydrocarbon gas to expel the other gas, and reach the tip in time to light up; and the wind gets blamed for the trouble. Another way of getting over the difficulty has been proposed, but, so far as the writer is aware, not tried in actual practice, and that is to use a battery to produce a spark to light a temporary pilot. This, however, would probably cost more than the saving in gas, besides damaging the mantles as in the case of the torch. Moreover, in cold and damp weather the battery rapidly fails, and one never knows when it is going to fail—thus imparting an element of doubt as to its operations.

Limitation of the Clock Controller.

Another limitation of the clock controller, which, however, does not arise to any extent in this country, is the practice of not lighting the street gas-lamps during moonlight nights; and in the case of fog coming on, the lamps must remain unlit, unless they are lit by hand. At the same time, there are many conditions under which a clock controller only may be used—where, for instance, a municipality do their own lighting and extinguishing, buying their gas from the local gas company. Naturally the municipality do not care to ask the gas engineer to alter his pressure to operate the lighters belonging to the municipality, when by so doing he materially reduces his output of gas.

Pressure Lamplighters.

Compared with clock controllers, pressure lamplighters possess many advantages. The lamps may be lit or extinguished at any, and not at only a pre-determined, time during the 24 hours, which is of advantage in the case of fog or early darkness. Again, they need not be lit on moonlight nights; and they can be simultaneously and instantaneously lit. On the other hand, most of those on the market are subject to many limitations and disadvantages which do not apply to clock controllers. In almost every case of pressure lamplighters, the motive power used is the gas pressure. In some cases the whole of it is employed; while in others only a portion is required, as will be explained later on. In the former case, the difficulty is that the pressure to be relied upon is a very variable quantity in some works, especially on the Continent, where low maximum pressures are used, whereas in others high pressures are employed. Taking, for example, 4 inches of pressure and a 4-inch bell on which the pressure acts, the force of the pressure is the weight of a cubic inch of water for each inch of pressure and each square inch of surface of bell; so that where a gas-plug has to be turned, the gross force available in the above example is 26½ oz., less the weight of the bell and of any mechanism attached to it that has to be lifted—which may be 8 oz.—leaving a net force of 18½ oz. to turn the tap. Supposing the pressure available is only 2 inches, giving a gross force of 13¼ oz., or a net force of 5¾ oz., this is not sufficient for the purpose; and the apparatus is therefore useless with low pressures.

Mercury Seals.

Many pressure lamplighters use mercury seals; water seals being apt to freeze, and requiring deeper seals and larger mechanism. The trouble of a mercury seal, however, is twofold. In the first place, its great affinity for most other metals limits the choice of metal of which to make the apparatus; and, secondly, the oily exudations of the gas act on the mercury, and mechanically decompose it into minute globules having the appearance of the dross that forms on the surface of molten lead. Consequently, in time the mercury ceases to be a seal; and if a light be applied a flicker of flame will be seen passing over the surface. This trouble may be overcome by removing the mercury, washing it in a strong alkaline solution, and then squeezing it through chamois leather. But this is costly when it has to be done on a large number of lighters. The mercury also becomes adherent in patches on the side of the bell, increasing the weight to be lifted; so that, though adjusted to operate at 4 inches, it does not do so until perhaps 42-10ths or 43-10ths is reached. Sometimes the pressure is raised much higher than is required to operate the lighter, with the result that the gas blows through the seal, and squirts particles of mercury on to the leaden weights, this making them still heavier; while sometimes with the high pressure the mercury reaches the bottom weight, and dissolves part of it, reducing the weight carried, and allowing the apparatus to operate at 37-10ths or 38-10ths.

Leather Diaphragms.

As an alternative to a liquid seal, a leather diaphragm is used in some lighters. It is, however, a very curious thing that it gets dry and hard much sooner than the same leather does in gas-meters. Even if a horizontal diaphragm has an extra dose of oil given to it *in situ*, the oil rapidly percolates through the pores of the leather, which becomes dry. The reason possibly is that the meter leather diaphragms are so much larger in surface than the

lamplighter diaphragms, so that the former act like a sponge that keeps it moist longer. In other cases, oiled silk is used instead of leather. This, after being in use a year, shows no perceptible sign of deterioration. It has also been tested under great heat, which has not affected its efficiency.

Gas Atmosphere.

In many pressure lighters the mechanism used for opening the valves works in a gas atmosphere. This forms a scale on the mechanism, which soon reduces its efficiency, and increases the friction, necessitating in time its removal for cleaning purposes. The expense of doing this discounts the value of the lighter by adding to the cost of maintenance. The gas seems to have a selective action on the metal employed in the manufacture of a lighter. Brass is affected slightly, aluminium is hardly touched, German silver is considerably affected, and gun metal most of all. On the other hand, the last-named material is best for contact with a leather diaphragm, being least affected by the oil and acid of the leather. A green verdigris is set up with brass.

Ordinary Pressure Lighter.

The ordinary pressure lighter consists of a base, containing an annular well, in which is placed an inverted cup or bell sealed in mercury; thus forming a gas-chamber in which are two valves—one to control the burner gas, and the other the pilot gas. Then attached to the bell is certain mechanism, which when the bell rises opens one and closes the other valve alternately. The aim of the inventor is to make the operation of this mechanism as free from friction as possible. Suppose the friction requires a force of 1800 grains to neutralize it, this translated into pressure acting on a 3-inch bell means an inch of pressure; but friction is an inconstant quantity, because vibration also in part neutralizes it. Now the 3-inch bell itself, with the mechanism attached to it, may weigh 3 oz. or 4 oz., which also equals an inch of pressure; so that to raise the bell so as to operate the mechanism a pressure of 2 inches is required—an inch to balance the bell and mechanism, and another to overcome the friction. It is very clear that the pressure must be dropped before it can be raised again for the next operation; and it is equally clear that the bell will not drop until some pressure is reached below that which is required to balance the bell—*i.e.*, 1 inch. This point may be called the engaging-point, and the other (2 inches) the operating-point; and the difference between the two is called the "range."

Friction and Vibration.

It will be observed that in this class of pressure lighter only a portion of the pressure is used to operate the mechanism—that is, the quantity required to overcome the friction. This class of lighter is adjusted to suit the different street levels and different pressures by placing leaden weights on the bell; thus preventing the apparatus from operating until a higher pressure—for example, 4 inches—is reached. The engaging-point in this case would be 3 inches. An element of uncertainty, however, now comes in—viz., vibration, caused by the street traffic and the wind—with the result that when the pressure has been raised to 3½ inches the friction is neutralized, and the bell rises and turns on the gas, possibly some hours before the proper time. And this range cannot be mechanically altered. For instance, to engage at 2 inches and operate at 4 inches, it is always 1 inch (except when affected by vibration) above the engaging-point. The operation of opening and closing the valves is performed practically instantaneously, giving rise to pilot troubles as before described.

Operating Pressure.

In order to work this lighter with anything like safety, it is necessary to permit it to engage at the maximum working pressure, and then raise the pressure 1½ inches to operate it—*i.e.*, 1 inch for the range and ½ inch for a safety margin; so that only in the case of gas-works having an abundant reserve of pressure can the ordinary pressure lighter be used with any degree of reliability. Such gas-works are few and far between. The holder pressure of a gas company varies considerably according to the quantity of gas stored. Suppose, for example, it is 8 inches maximum and 4 inches minimum, and the maximum working pressure is fixed at 4 inches, under ordinary conditions it is quite easy to give the extra 1½ inches required to operate the lighter. But the time comes—perhaps once in a hundred times—when there is only the minimum holder pressure of 4 inches; and the lamps cannot be lit. Consequently, if, in order to get over this trouble, they are set to light at 4 instead of 5 inches, they may frequently light in the afternoon, when 3½ inches is reached, and a subsequent drop to 3 inches may take place, Then when lighting-up time comes, the pressure is raised to 4½ inches, and those lamps that are lit are extinguished. Supposing the gas company have a large cooking-stove consumption at luncheon-time, and raise their pressure to 4½ inches to meet it, the lamps would be lit up. Or supposing the minimum holder pressure is 6 instead of 4 inches, the other pressures remaining the same, and the mains in some portion of the district happen to be small, and the consumption, when once it starts, causes a drop of 2 inches. In such case the lamps would have to be lit half-an-hour or an hour before their time; thus doing away with any saving in gas, and probably causing a loss on the lighting contract. Even if the lamp is lit before the consumption starts, this takes the pressure down below the engaging-point. Then when the consumption ceases, the pressure rises, perhaps at 10 or 11 p.m., and puts the light out; and if it is not relit by hand, the rise in the pressure in the morning to extinguish the lamps will relight those that went out during the night. It will thus be seen that the conditions must be made to suit this class of lighter (and this, in nine cases out of ten, is, in the writer's opinion, impossible) or it will not give satisfaction. Almost without exception, pressure lamplighters will only meet one set of pressure conditions; so that if conditions cannot be altered, the only alternative is a clock controller or else manual lighting.

Entirely Satisfactory Pressure Lamplighter.

Assuming the use of an entirely satisfactory pressure lamplighter, the saving to be effected by it, is in labour and gas. But it does not follow that the whole of the saving goes to the gas company, as this depends on the conditions of the contract with the local authority. The saving in labour varies indefinitely. The wages paid are usually 25s. per week, with perhaps 1s. or 2s. less to improvers. This appears at first sight a very low figure, especially when it is remembered that the work is done largely during the night. But against this the number of hours worked per week is small compared with those in other branches of labour. They vary from 40 to 50 hours, and average about 45 hours, which gives 6½d. per hour.

The time allowed for lighting and extinguishing varies. With some companies it is 1¼ hours and with others 1½ hours for each operation; there are cases where 2 hours are allowed. Then, again, the number of lamps in a man's round varies. In large towns, where the lamps are close together, the number may be 100; in the suburbs, where they are farther apart, from 60 to 80; and in the distant suburbs, where they are few and far between, perhaps only 40. Taking the minimum time, and the maximum number of lamps (they generally go together), it works out as follows: 2½ hours per day is 912 hours per year, and at 6½d. per hour this comes to 4s. 11¼d. per lamp per annum. If the number be 70 and the time 1½ hours, the result is 8s. 4½d. Taking the maximum time at 2 hours, with the minimum number, the result is 19s. 9d. It will, however, be found in practice that the average saving in labour is about 8s. per lamp per annum. As regards the saving in gas, this also varies largely according to conditions. If the ordinary pilot burner is used, 1170 cubic feet may be saved in the pilot alone. If the torch is used, it means a debit of 1380 cubic feet against the automatic lighter. It must, however, be remembered that to effect this saving by the torch considerable capital outlay is required.

There is another saving of gas effected by the lighter by lighting the lamps simultaneously at dusk instead of starting from one to two hours before that time. The average for each operation being half the time allowed, or from 1¼ to 2 hours per day at 4 cubic feet per hour, this equals 1825 to 2920 cubic feet per lamp per annum, so that even in torch-lit lamps there is a saving of from 450 to 1540 cubic feet, while, on the other hand, the maximum saving may be 4090 cubic feet. If we average the price of gas at 2s. 6d. per 1000 cubic feet, the money saving would be from 1s. 3d. to 10s. Taking the minimum savings in gas and labour, the sum is 6s. 5¼d., while the maximum is 29s. 9d. per lamp per annum. A safe average would be 10s. to 15s. per lamp per annum.

Cluster Burners.

Where two burners are employed in one lantern, with the use of a special tap, one may be extinguished by hand at midnight, at a cost of 8s. per lamp per annum. The saving in gas being averaged at 5½ hours per day, at 4 cubic feet per hour, equals 22 cubic feet, or 8030 cubic feet a year, which, at 2s. 6d. per 1000 feet, comes to £1. The lighter therefore saves this or the man's labour *plus* the cost of a special tap. There is also a certain saving of from 10 to 50 per cent. in mantles and chimneys by the use of the automatic lighter. These figures are on the assumption that a perfect lamplighter is used. Where the lighter is not satisfactory, they will have to be discounted to the extent of the cost of the maintenance of the lighter.

Gas Publicity.—Three examples of gas publicity which came under notice last week deserve brief mention. In the "Daily Mail" on Friday, there was a page headed "Home Lighting and Heating for Winter," in which gas came in for attention, and an advertisement of the Gaslight and Coke Company had a prominent place. The Company also had a very effective page in the first Woman's Supplement to "The Times," which appeared on Saturday. A page of the "Manchester Courier" last Thursday was devoted to the Glasgow Exhibition, of which a general view was given, as well of Messrs. Fletcher, Russell, and Co.'s stand. Advertisements of the firm and of other exhibitors associated with the gas industry occupy the outside columns.

Production of Carbon Dioxide from Scrubber Water.—A French patent has been taken out by M. Fillunger for the production of pure carbon dioxide from the water coming from the scrubbers in the process of manufacturing coal or coke-oven gas. According to an abstract of the specification in the "Journal of the Society of Chemical Industry," the patentee points out that the gases obtained in distilling gas liquor for the recovery of the ammonia consist, after the absorption of the ammonia by acid, of carbon dioxide, water vapour, sulphuretted hydrogen, cyanogen compounds, as well as traces of sulphur dioxide and of hydrocarbons. These impurities are removed by bringing the gases into contact with lyes containing metallic salts—for example, liquor obtained in extracting copper from burnt pyrites. The gases are further purified by passing them over red-hot copper oxide, or by absorbing them in potash so as to form potassium bicarbonate, and then decomposing the bicarbonate by heat.

A NEW PROCESS FOR THE RAPID ESTIMATION OF SULPHUR AND SULPHURETTED HYDROGEN IN ILLUMINATING GAS.

By C. Winthrope Somerville, of the South Metropolitan Gas-Works, Bankside.

The daily increasing refinements in gas manufacture demand a corresponding use of efficient instruments for analysis and general testing; and in the matter of purification especially, rough and ready methods have been too long in existence.

The absence of better processes for controlling the working of purifiers is, perhaps, a valid excuse for using an indifferent one for something like forty years; but the author is under the impression that more energy has been expended in trying to improve a poor process than in seeking a better one.

Those controlling the purifiers are naturally desirous of obtaining the greatest possible duty from their material; and to be able to ascertain with accuracy, in the space of a few minutes, the precise conditions of a purifier with regard to its sulphur or sulphuretted hydrogen content, is both necessary and desirable. To this end, the author has been carrying out some investigations into possible processes to supersede the inefficient ones of the present time, with the result that he has designed one in which the reactions are indicated by a colour disappearance of such sharpness as to leave no doubt in the mind of the operator.

Hitherto the Harcourt test has, almost universally, served the purpose of making rapid estimations of CS_2 and H_2S; but the process has its limits as regards accuracy and the purposes for which it is employed.

The whole of the sulphur content of the gas is not recorded by it; it is unreliable with small quantities of either impurity; and the exact temperature at which to work for the determination of CS_2 has never been agreed upon. This, in conjunction with the difficulty of colour matching, leads different operators to get different results when testing on the same gas over a similar period of time.

The necessity for different standards for testing by daylight, flat-flame and incandescent gas-lights, and the deterioration of these standards, militate considerably against the usefulness and the efficiency of a process. The author would also like to suggest that it is more convenient to have the results of determinations of sulphuretted hydrogen given in terms of that impurity instead of in terms of sulphur.

In determining the form the new test should take, there was very little room for choice—a colour test, if possible to obtain, being eminently the most suitable. The author originally confined his investigations to a process for estimating total sulphur, and experimented in the direction of passing the products of combustion from burning gas into a solution of standard alkali coloured with various indicators. But the colour change was too indefinite, especially when hydrogen peroxide was used to ensure the oxidation of the sulphurous acid into sulphuric.

Finally, advantage was taken of the well-known reaction between iodine and sulphur dioxide, in which the free iodine is indicated with starch, giving the intense blue coloration; and this colour was found to disappear instantly when the sulphur dioxide in the products of combustion became in excess of that which was required to absorb a definite weight of iodine contained in the reaction bottle.

It has been found that no other constituent of the products of combustion reacts with the iodine to interfere in any way with the test.

The new process for the estimation of total sulphur is based on the following reaction:—

$$SO_2 + 2I + 2H_2O = H_2SO_4 + 2HI.$$

The gas is passed through a meter and burned. The products of combustion, after being cooled slightly, are carried through a solution containing 100 c.c. of N/1000 iodine in a total volume of about 450 c.c., made up with either distilled or tap water, and to which is added starch indicator. The weight of iodine in this solution is 0·01268 gram. It will be seen from the equation that 253·72 parts of iodine are equivalent to 64·06 parts of SO_2; consequently 0·01268 gram of iodine is equivalent to 0·0016 gram of sulphur, or 0·024688 grain.

When sufficient gas, containing in the products of combustion the equivalent quantity of sulphur to the above weight of iodine, has passed, there occurs an instantaneous decoloration of the blue solution to colourless water; the sharpness of the reaction depending on the amount of sulphur in the gas. Thus with gas containing 40 grains of sulphur per 100 cubic feet the reaction takes place over a period equal to the passage of 1-2000th of a cubic foot of gas; while with gas containing 20 grains per 100 cubic feet the reaction takes place over a period of 1-1000th of a cubic foot.

Upon the decoloration of the solution, the consumption is noted; a simple calculation giving the grains of total sulphur per 100 cubic feet.

A smaller or larger volume of the iodine solution may be used, if desired, thereby reducing or increasing the duration of the test. Using 50 c.c. of iodine, with gas containing about 30 grains of sulphur, the time occupied is from two to three minutes.

The process has been checked against the Gas Referees' and standard gravimetric methods at various parts of the gas-works plant, giving comparative results in all cases, a few of which are noted below —

	Standard $BaSO_4$ Test.		Somerville Test.
1.	28·6	..	28·3
2.	36·8	..	36·6
3.	44·3	..	44·8
4.	18·7	..	18·9
5.	21·7	..	22·0

A cubic foot of district gas was collected in a bottle, and the gas delivered to the meter by displacement with water. A series of nine estimations were made on this sample to test the concordance of the results.

1.	27·6
2.	27·6
3.	27·4
4.	27·4
5.	27·2
6.	27·1
7.	26·9
8.	27·0
9.	26·8

Note.—The gradual decrease is probably due to the absorption of CS_2 by the water.

In testing, the gas is burned in a bunsen burner at the rate of ½ cubic foot per hour; and a simple form of water-jet vacuum pump is used to support the combustion of the flame and carry the products through the reaction bottle.

In designing the apparatus, the chief points considered were: Temperature of products entering the iodine solution; volatility of iodine; sufficient seal for complete absorption of SO_2; speed of gas; splitting-up the gas for effective washing; visibility of reaction; sharpness of reaction; portability; simplicity.

With regard to the use of iodine as the reagent. Many works on volumetric analysis solemnly warn the chemist as to the liability of a solution of iodine to lose its strength with keeping; and the author started his investigations with fear in his heart as to whether, on this account, it was worth while doing anything with it. After eighteen months continual experience with it, however, he is glad to be able to regard the warning as something in the nature of a "bogey." A decinormal solution of iodine, made up in the ordinary way with potassium iodide, and kept in a dark cupboard, has maintained its strength (to within 1 per cent.) for nine months; also another solution, made up with 50 per cent. of glycerine as an experiment, has lost nothing in six months.

Estimation of Sulphuretted Hydrogen.

In applying the principle to the estimation of H_2S the author encountered rather more difficulties than was anticipated. Gas containing H_2S passed direct into a solution of iodine and starch, does not give an indication of the amount of impurity according to the equation.

$$H_2S + 2I = 2HI + S.$$

First, unless the gas be passed exceedingly slowly, and through an impossible depth of solution, the H_2S is not completely oxidized. Secondly, the presence of any hydrocyanic acid helps to discharge the colour.

It was found that the solution, apart from the iodine, must be capable of retaining the H_2S; also that the usual precautions recommended in the volumetric estimation of H_2S in solution by iodine must be carefully observed. These and several other chemical details had to be overcome; and when finally embraced in a specially prepared and carefully adjusted starch solution, exact results were obtained.

In the gas used by the author, it was found that hydrocyanic acid was the only other constituent that helped to discharge the colour or interfere with the test, and the volume of this varies from *nil* to a few grains.

During the passage of the gas through the reaction vessel, the whole of the HCN is not extracted, but only a definite proportion—dependent upon the depth of seal. But this proportion seems to be constant, with considerable variation in the speed of the gas.

Since every effort to extract the HCN previous to entering the reaction vessel, without also extracting the H_2S, was unsuccessful, it was arranged to make duplicate tests, in the second of which the H_2S is extracted by lead carbonate, which has no effect on HCN. By deducting the second result from the first, the H_2S is obtained.

It was then found that in testing gas containing more than 75 grains of H_2S per 100 cubic feet, the volume of gas required was so small as to make the HCN recorded a negligible quantity. It was also found that, owing to the speed and certainty with which the test could be carried out, even on comparatively clean gas, three duplicate sets of estimations could be made in the time required to make one estimation by the Harcourt test on the same gas. In practice, it will be found that these duplicate tests are very rarely, if ever, required.

With any gas containing a constituent, other than HCN, which helps to decolorise the solution, the H_2S would, of course, be estimated in the same way, providing the lead carbonate was unaffected—thus rendering the process available for all gases.

In testing, the gas is passed direct into a reaction vessel of about 100 c.c. capacity; the inlet tube having a bore not greater

than 0·5 mm. diameter. The outlet is connected to an aspirator; and the speed is regulated according to the amount of H_2S that is present. The time occupied by a test varies from five seconds to two minutes.

There are used 10 c.c. of N/1000 iodine (with 10 c.c. of starch); being equivalent to 0·0026231 grain of H_2S. The water from the aspirator measures, in cubic centimetres, the volume of gas that is used.

The decoloration with gas containing only 5 grains of H_2S occurs over a period of about 3 c.c., in which case 20 c.c. make a difference of 1 grain of H_2S. With gas containing above 50 grains per 100 cubic feet, the decoloration is instantaneous.

By means of the process, it is possible to estimate from one to thousands of grains per 100 cubic feet.

The Starch Solution.

The accuracy of both processes is dependent on two things—the correct weight of iodine in the reaction vessels, and the starch solution.

For the estimation of total sulphur, an ordinary starch solution as recommended by the test-books may be used—*i.e.*, 1 gram of starch per 100 c.c. But here a word of warning! The author has found that starch which has been purchased in powder form and kept for some time, is liable to be a source of error; for whatever precautions be taken in the making, there is a tendency for particles to granulate and retain the starch iodide, and thus prevent the decoloration of the solution.

Starch, such as Colman's, should be purchased in lump form; put in a stoppered bottle; and ground just before using.

The keeping qualities of a starch solution are very poor; and it was found that, after a few days, a good blue colour could not be obtained. This may be remedied by including in the solution about 2 per cent. of alcohol, and rendering it just alkaline by sodium hydrate, when it will keep, and give a good colour, for at least a month.

In the estimation of H_2S the starch is a special preparation adjusted to the weight of the iodine; and a measured quantity has to be used. From the formula supplied to the manufacturers of the apparatus (Messrs. Townson and Mercer) the starch is sent out in sealed bottles of 1 oz. capacity, and when made up according to the instructions the solution will keep, it is believed, indefinitely—always giving an intense blue colour. It may be used for the sulphur estimation in quantities of 3 to 7 or 8 c.c.; but for the estimation of H_2S, not less than 9 c.c. and not more than 11 c.c. should be used with the given volume of iodine solution.

Iodine Solutions.

For checking iodine solutions, the author recommends weighing out accurately the required weight of previously ground and pressed pure sodium thiosulphate, and titrating the solution of iodine into the thiosulphate solution.

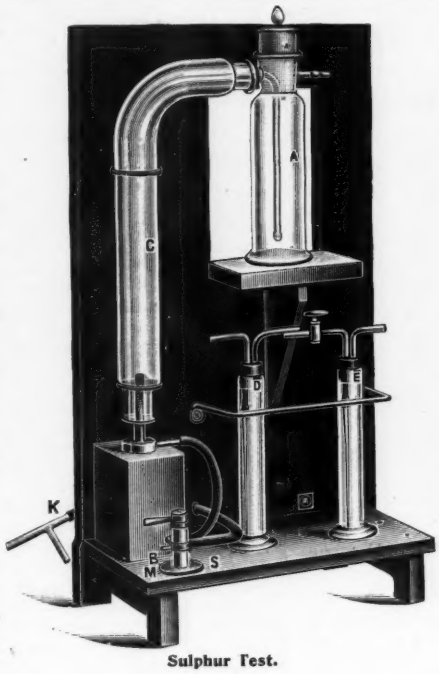
For the solution of iodine in daily use, the author recommends glass reservoirs with taps, the top fitted with a rubber cork pierced with a short thistle funnel containing soda lime as an air purifier. The reservoir should be painted black.

Illustrations are given showing the test ready for estimating both impurities, but the purifier D is incorrectly shown, the correct shape being that of a calcium chloride drying tower. Fig. 1 shows the apparatus ready for estimating total sulphur; fig. 2 shows the apparatus ready for estimating sulphuretted hydrogen.

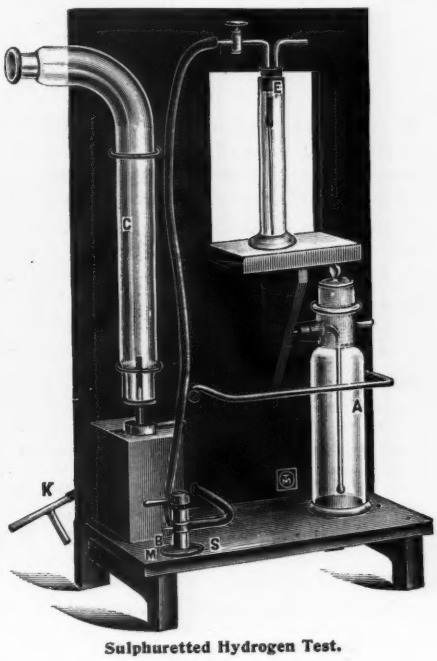
To Use the Apparatus.

Sulphur Test.—The gas is connected from the service to the inlet arm of the T-piece K. One outlet arm of this goes to the meter inlet; the other to the inlet S of the three-way cock. The outlet of the meter is connected to the inlet M of the cock; and the outlet B of the cock is connected to the burner under the combustion tube C. When the decoloration of the solution occurs, the three-way cock is switched from M to S—thus stopping the meter, and allowing the gas to remain burning. The air to support the combustion of the gas and the products of combustion are carried through the reaction bottle A by means of a rubber-tube connection from the water jet vacuum-pump P. When the test is finished, A is disconnected from C, and the gas switched back from S to M—thus allowing it to pass through the meter again in readiness for the next estimation.

Sulphuretted Hydrogen Test.—Here an aspirator is used for measuring the gas. The inlet arm S of the three-way cock is connected to the service, and the outlet arm B to the reaction vessel E. The outlet of E is connected to an aspirator. When estimating traces of H_2S in the presence of HCN, a lead carbonate purifier D (wrongly shown in fig. 1) is placed between B and the vessel E, and a test made. A second test is then made with B connected directly on to E. The difference of the two results, in grains per 100 cubic feet, gives the H_2S.



Sulphur Test.



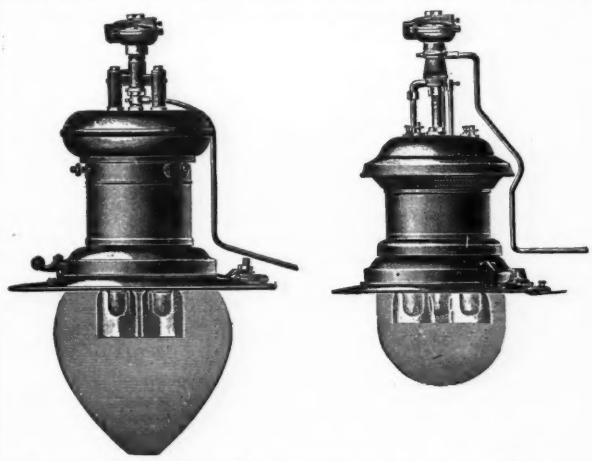
Sulphuretted Hydrogen Test.

In conclusion, the author would point out the advantage of being able to vary the volume of iodine solution used in either test, for the purpose of increasing or decreasing its duration and the volume of gas used.

LOW-PRESSURE "GRAETZIN" LAMPS

For Outdoor Lighting.

In the accompanying illustrations are shown two high-power "Graetzin" lamps, working at low pressure, suitable for outdoor lighting, to which our attention has been called by Messrs. J. & W. B. Smith, Ltd., of Farringdon Road, E.C. Both lamps are black enamelled; and the larger one is fitted with an automatic gas-regulator at the top, air adjusters at the side of the casing, and a flash bye-pass. There are three burners, each of which has a separate control. A side lever movement, with all-night attachment, enables the lamp to be used with all the burners alight or



with one on and two off. The lamp measures 31 inches over all, and it is stated to give a light of 1000-candle power with a consumption of about 23½ cubic feet of gas per hour. The smaller lamp, which, like the other, is fitted with an automatic gas-regulator, side lever movement, flash bye-pass, and separate control to each burner, measures 26 inches over all; and it is claimed for it that with a consumption of 14 cubic feet of gas per hour it will give a light of 600-candle power. The lamps are very suitable for lighting large areas.

Vertical Retorts for Amsterdam.—We learn that the Dessau Vertical Retort Company have just received a large order from the Amsterdam Municipality for the erection of vertical retorts on the Dessau system at the new Southern Works. The installation is to comprise thirty beds of eighteen retorts—540 retorts in all.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Newcastle.

The Sixty-Seventh Half-Yearly Meeting of the North of England Gas Managers' Association was held at Newcastle on Saturday. There was a very large attendance. The company assembled at the North of England Institute of Mining and Mechanical Engineers, Neville Street, whence they drove in special cars to the Elswick Ordnance Works of Messrs. Armstrong, Whitworth, and Co., Limited. There an hour was spent under guidance, walking through the vast works, in which were seen numerous big guns in course of construction, as well as the turrets and other interior fittings for the warship "Hercules," recently launched in the Tyne. Among other processes which were looked at with interest was the cutting of steel plates by the oxy-acetylene blow-pipe, which was considered very smart work. Returning to the Mining Institute, the meeting was constituted by Mr. J. LEWIS, of Newcastle, taking the chair.

NEW MEMBERS.

On the motion of the Hon. Secretary—Mr. H. LEES, of Hexham, seconded by Mr. MATT. DUNN, of Stockton, the following were admitted to the Association:—

Members.—Messrs. Bertie Culvert, of Northallerton, John W. Ford, of Hessle-on-Hull, Theodore Nicholson, of Willington, Co. Durham, and Charles Wood, of Bradford.

Associates.—Messrs. Fred D. Hinchcliffe, of Hexham, Frank L. Scaife, of Stockton-on-Tees, and Wm. Thirlaway, of Newcastle.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—I am not aware that a Distributing Engineer has occupied the presidential chair of any other Association of Gas Engineers and Managers in the United Kingdom. But certainly, by virtue of your kindness, I am the first to be elected to the chair of the North of England Gas Managers' Association; and it is an honour which I greatly appreciate.

The distributing department of a gas undertaking has, of recent years, come rapidly to the front; and the reason is readily comprehended when the many advances in, and the widened range of, the application of gas is taken into consideration.

Practically the whole of the consumption was, not many years ago, under conditions now entirely out of date, and by apparatus which could not be compared with that of the present day in regard to either scientific construction or multiplicity. As a natural consequence, the technical knowledge which then sufficed for the carrying on of the department is incomparable to that which necessity now exacts. Competition and the demands of the public have brought about this change, with the result that one-time independent and sometimes unobliging suppliers of a public commodity are now transformed into enterprising tradesmen. It is now necessary to be cognizant of apparatus to suit all requirements, the true value of the various appliances, the continuous improvements in them, and their correct adaptation; to see that the whole of the work is thoroughly organized and administered; and, among other things, to exhibit a strong desire to do everything possible to satisfactorily anticipate the wants of consumers and develop the use of gas.

As indicating the growth of distribution departments, I give you the following figures relating to the Company I have the honour to serve, which will be proportionately representative of other undertakings.

	Jan. 1, 1910.	Dec. 31, 1909.	Increase.
Consumers—			
Ordinary	38,934	49,809	10,875
Prepayment	—	59,467	59,467
Cookers on Hire—			
Ordinary	2,420	9,395	6,975
Prepayment	—	53,450	53,450
Grillers on Hire	—	6,002	6,002
Fires on hire	—	3,639	3,639
Public lamps	10,090	14,754	4,664
Private incandescent burners maintained	—	17,046	17,046
Miles of main	485	752	267
Consumers per mile of main	80	145	65
Employees	440	750	310
Weekly pay bill	£560	£930	£370

The carrying out of this increased volume of work has, of course, resulted (in addition to the capital expenditure) in a gradually increasing annual expenditure on distribution in the revenue account; and as from time to time the services which it may be deemed desirable to render to consumers multiply, so may the distribution account be expected to increase. But the fact that a great change has taken place in the work of the department furnishes a reason—the best of reasons—for looking around to see that one's methods of ascertaining what things cost, checking waste in both time and material, keeping pace with the change in the work, and satisfying oneself that, although higher total costs may be expected, they are not higher than they ought to be.

A JOB COSTING SYSTEM.

This Company, with a view to making the methods fit the altered circumstances in an up-to-date manner, about two years ago (upon the initiation of their worthy Secretary, Mr. Waddom) decided to introduce in the Distribution Department that which is now becoming general in large manufactories managed on modern lines—viz., a job costing system. The introduction necessitated many changes in the then existing methods; but the work involved has been amply justified.

As I am a believer in presidential addresses containing rather full information on one subject, which, of course, means brief reference to any other, and as I think the working of a job costing system in a distribution department will be of interest, I propose to devote the major portion of my address to this subject, and in doing so shall endeavour to make the same as plain as possible, though this is not easy.

I shall first divide the system into the following main headings, and then consider *seriatim* the details under each.

1. *Orders.*—Those received at the chief offices are sent to a "Central Order Receiving and Reports Office" at the workshops, and from there distributed to foremen, who give each job a number and despatch workmen to attend to it. The workmen, on their return, report particulars of the work done to a reports clerk, who despatches the information to the department from which the order was received and also to the costs office.

2. *Time and Job Keeping.*—Workmen are paid from time cards, on which are recorded the times of commencing and finishing work each day; these being checked with the time spent on the various jobs as shown by job cards on which are recorded the times of commencing and finishing each job.

3. *Stores.*—The stores issued for jobs are charged against respective jobs, and these, with the stores in stock, are checked with the stores purchased.

4. *Assembling.*—The assembling of all charges against jobs shows on the weekly costing sheets the cost of each individual job (except those entailing very small costs), and each class of job, and the relationship of the costs accounts to the general accounts.

5. *Scrutiny.*—There is a scrutiny of the weekly costs sheets and utilization of same.

ORDERS.

As to orders, I may explain that there is a chief office in Newcastle and a branch office in Gateshead, where orders and complaints are received from consumers; and we have a central workshop in Newcastle where all classes of work (other than in connection with prepayments) are dealt with; a branch workshop in Gateshead, where most classes of work (other than prepayment work) are dealt with; and three workshops in different parts of our area, where only prepayment work is handled.

In describing the costing system, however, I shall confine my remarks, for the sake of lucidity, to the orders received at the chief office and executed by the central distribution workshops. The principles are the same with the branch office and workshops; but the details are slightly modified to meet the different circumstances.

Consumers' complaints and orders for new work—both of which I shall hereafter refer to as "orders"—received at the chief office, are there entered upon numbered triplicate forms. Different forms are used for each class of order, and one form used for each order. That shown in Illustration No. 1 is for laying

N. & G. Gas Co. Chief Office.	NEW METER AND SERVICE PIPE. Form No. 29. 249906/66	Office No.
		Workman's No.
Name		
Address		
Fix	Light Meter on Loan, or Sale	
and lay Service Pipe		Charge
Note		

Order Received.					Despatched to Workshop.	Despatched to Foreman.
Date.		Hour.	Min	By		
				Clerk.		

Illustration No. 1—size 6¾ inches by 4 inches.

a new service pipe and fixing a new meter. The two slips and card comprising these forms are gummed at the left-hand side. As much as possible of the general matter for each class of form is printed, in order to minimize time and labour in the office; and the matter which is to be added by hand, in filling up the

form, is made on three copies with one writing by the use of a two-faced carbon sheet placed between the second slip and the card—the transparent nature of the second slip permitting the impression on the back thereof to show through distinctly.

The two top copies of these orders are despatched at fixed times during the day to the workshops; the time and date of handing to the messenger being stamped thereon by the use of a time and dating stamp. The copy retained at the chief office is put into a table cabinet the top of which is divided into numerous well sections for the reception of different classes of orders; and there it remains until the receipt of a report from the workshops to the effect that the order has been completed. This affords a ready means of detecting any delay that may occur in completion, as each class of order is automatically arranged in chronological order of issue.

The two copies of the orders despatched to the workshops are received in the order receiving and reports office, where the orders clerk has a well table cabinet divided similarly to that just described. Into the correct section or compartment of this one copy is placed, and there remains until the completion of the work; the other copy being sent to the foreman in charge of the class of work to which the order refers—the time and date of the despatch to him being stamped thereon, so that any delay can be traced to the spot where it occurs.

It will be evident to you that by this table we can at once ascertain how many orders of each class we have in hand in the whole works; and, as here again they are automatically arranged in chronological order, we can see the length of time we have had them, and it is the duty of the orders clerk to report to the chief clerk any orders upon which there happens to be unnecessary delay.

This table has the further practical utility, that when (as you all know sometimes happens) an unusual number of orders of one class is received, and there is danger of delay in execution, and consequent irritation on the part of the consumers, we are able to deal promptly with the situation by transferring men from other classes of work where there may be a slackness, or by taking on extra hands if all departments are fully engaged.

But to follow the orders through—the foreman, having received copies of orders from the orders office, selects his men for the various jobs. Meanwhile, his clerk writes out a job card for the work which the man has to execute. As Illustration No. 1 is for laying a service pipe and fixing a new meter, we shall continue this order; and Illustration No. 2 shows the job card for the work.

Back of Card.

N. & G. Gas Co. Form No. 6.

No._____

Name_____

THIS SIDE OUT.

Office No. _____ Job No. P/_____	Name	Address	Fix Meter	Bring in				and service pipe size
			Lights	Maker	Maker's No.	Coy.'s No.	Year made	Meter reading

Reinstatement

Face of Card.

N. & G. Gas Co. ORDINARY METER AND SERVICE PIPE JOB CARD.

Distribution Dept.

Workman's No._____

Name_____

Job No. P/_____

Office No._____

Date_____

DAY	Started	Stopped	Restarted	Finished	TOTAL
A.M. F P.M.					
A.M. S P.M.					
A.M. S P.M.					
A.M. M P.M.					
A.M. T P.M.					
A.M. W P.M.					
A.M. T P.M.					

	Hours.	Rate.	£	s.	d.
Ordinary Time					
Overtime . .					
Total . . .					

Illustration No. 2—size 7½ inches by 2¾ inches.

The illustration shows both sides of the card—the back is self-explanatory. The face shows the office order number, which is that of illustration No. 1, and also shows a job number which the work now receives and retains throughout.

For the job in question a plumber and labourer are required. The former takes the job card (Illustration No. 2), and the labourer is given a similar card, but without any particulars of the job being entered on the back. Upon receiving these job cards, the men immediately register the time in the spaces shown on the face of the card in the "Started" column, by means of a time-recording machine, to which I will refer later.

The assistant procures tools while the plumber proceeds to the stores for the material required for the job; and to the question of stores, I will also refer later.

The men then proceed to the address shown on the plumber's job card, execute the work, and return to the workshops. The plumber then reports to his foreman that the job is completed, and is handed the foreman's copy of the original order. (Illustration No. 1.)

The foreman takes this opportunity of asking questions upon any point regarding the work. If he considers it necessary, he inquires the reason of excessive time having been spent on the job; and if the explanation be unsatisfactory, the question is further investigated and dealt with accordingly.

The workmen then register the time on their job cards in the "Finished" column; and the plumber proceeds to the reports office, where he hands in the copy of the order just received from the foreman, and his job card (having first entered his report on the back), and verbally reports to the clerk any incidents out of the ordinary which may have arisen. The clerks have been trained to this work, and they know how to elicit all necessary information, and put the same concisely in writing.

The workman is then ready for his next job; but to follow the order right through, the reports clerk, from the job card, writes out on a triplicate form (Illustration No. 3) a report of the work done. Here, again, distinct forms are used for each class of work, printed to reduce to a minimum the writing required.

We shall now follow the disposal of the three copies of the report just written out, and of the two copies of the original order relating to the job (the copy which we saw put into its own section of the well table on receipt at the workshops, and the other just handed in by the workman).

N. & G. Gas Co., Distribution Dept. Forth Street.	NEW METER AND SERVICE PIPE. Form No. 30 249906/91	Office No.
Name		Job No.
Fixed Light Meter on Loan (or Sale)	Maker	Year made
Maker's No.	Co.'s No.	Meter Reading
Service Pipe		
Work completed	Reinstatement Yes No	Reports Clerk

Received from Workshop.	Rental Dept.	Meter Reading Dept.
	District..... Rental No.....	Card No.....
Consumers' Dept. (Gen.)	Clerk	Inspector

Illustration No. 3—size 6¼ inches by 4 inches.

One copy of the report is sent to the office or department which issued the order; and when received, it is attached to their copy of the order, and both are then filed away for future reference. Another copy of the report and one copy of the order are now despatched to the costs department at the chief office, where all the charges against the various jobs are assembled.

On the report forms, it will be noticed, spaces are provided for stamping the dates and times of despatch and arrival; and thus any delays in transmission are quickly observed.

There still remain at the workshops one copy of the order and one of the report, which are now filed away in what we call the "Street Index Cabinet," consisting of several shallow drawers, each divided into sections running the length of the drawer. The orders and reports are filed in these drawers alphabetically, according to the names of the streets, which are indicated by guide-cards. A little rack divided into pigeon holes is used for sorting the forms into alphabetical order, preparatory to filing them away in the cabinet. The street index has been found to be extremely useful, as it affords a record of all work done in any street or on consumers' premises in that street. Information as to details of work done is quickly found; and from the job number quoted on the report, we are able to easily follow up details of time occupied, material used, and total cost.

The orders and reports having been disposed of, the job cards are examined in the orders and reports office, to see which jobs involve street reinstatement; and from these, orders are issued to the various local authorities, all of whom do the reinstating work within their respective areas for the Company.

The following diagram is intended to indicate the course of the orders and reports—the plain lines showing the issue and execution of the order, and the dotted lines, the reports of work done. (Illustration No. 4.)

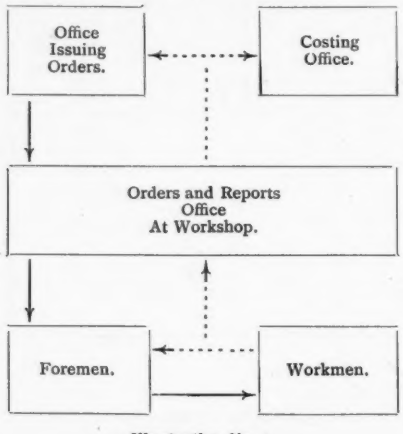


Illustration No. 4.

TIME.

The method of time-keeping is that each workman has his number, the same as with an ordinary time-board system; but instead of a time-board, he has a weekly card, which, at the beginning of the working week, is placed in the rack—marked A in the following illustration (No. 6)—containing slots numbered to correspond with the card numbers.

The man, as he enters, takes his card out of this rack, and records the time of entering on the card, which he then puts into the rack lettered B. When he leaves for the day, the reverse operation takes place—thus leaving the card in A ready for the next morning.

All cards left in rack A in the morning show at a glance the absentees; and the racks are locked immediately the men have finished recording their time. The cards are afterwards taken to the time office to have the previous day's time carried to the "total" column.

N. & G. Gas Co. Distribution Dept.

No._____

Name_____

Week ending_____

DAY	IN	OUT	IN	OUT	TOTAL
A.M. F P.M.					
A.M. S P.M.					
A.M. S P.M.					
A.M. M P.M.					
A.M. T P.M.					
A.M. W P.M.					
A.M. T P.M.					

	Hours.	Rate.	£	s.	d.
Ordinary Time					
Overtime					
Total					

Illustration No. 5—size 7 inches by 2¾ inches.

If a workman fails to register at night, owing to finishing late on an outdoor job, his card is placed in its proper slot in the first rack by the timekeeper. The workman, after registering his starting time next morning, instead of placing his card in the second rack, enters on it (in writing) his time of ceasing work the previous night, and takes it to his foreman to be initialled. The card is then given in to the timekeeper, who places it in its proper slot in the second rack.

The workmen have become accustomed to stamping their cards; and the operation is got through very quickly. All writing, save that of entering the names on the cards, is done away with; the dates being put on by a stamp and the numbers printed by a numbering machine. Thus, with less labour, we have a permanent record of each man's time, imprinted by his own agency, the accuracy of which he cannot afterwards dispute.

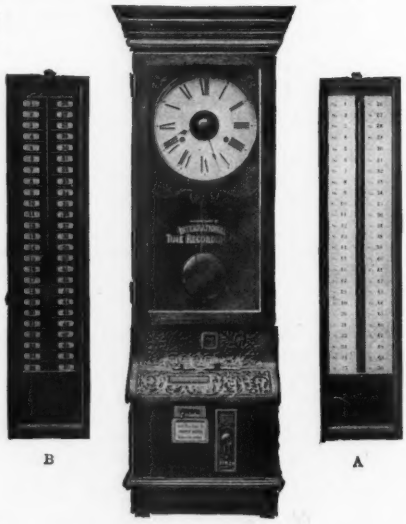


Illustration No. 6.

A record of the behaviour of these clocks, since they were first installed, shows that they have kept splendid time, and required very little maintenance. Precautions are taken, however, to have them timed weekly by a public clock which is controlled from Greenwich.

We make a practice of having an official present when the workmen register their time on commencing and leaving work, whose duty is to see that the workmen pass through without undue crowding likely to cause waste of time, &c.

FIVE SEASONS AGO

the **"WIZARD"** started the New Gas-Fire Movement. Following the practice we had originated years before with our other Stoves, and had been pressing upon the attention of the Industry, the "Wizard" was **Interchangeable** in every part.

FOUR SEASONS AGO

came the **"MASCOT"**—**Interchangeable** with itself and with the "Wizard."

SEASON BY SEASON SINCE

has come a succession of fresh creations:—The "Druid," "Stadium," "Forum," "Salon," "Warlock," "Arch-Druid"—each **Interchangeable** with every one of the others.

Not only did we **originate** this **Interchangeability** System in Gas Fires, but we have steadily developed it, so that to-day we have **8** designs, forming

30 DISTINCT STOVES, ALL INTERCHANGEABLE THROUGHOUT.

OUR POSITION IN THIS RESPECT STANDS UNAPPROACHED.

In **Interchangeability** we set the example years before others began to follow it.

We are still **FIRST;** and there is really **NO SECOND.**

JOHN WRIGHT & CO., The Pioneers of Interchangeability and Standardization in the Gas-Stove Industry,

Essex Works, BIRMINGHAM.

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FIDDES ALDRIDGE

SIMULTANEOUS ONE STROKE STOKING MACHINE

WE DRAW YOUR ATTENTION TO RECENT LONDON ORDERS.

BECKTON. WATFORD.

TOTTENHAM. STRATFORD.

ALDRIDGE & RANKEN,

39, VICTORIA STREET,

LONDON, S.W.

Telegrams: "MOTORPATHY, LONDON."
Telephone: 5118 WESTMINSTER.

Avonbank Works, BATH.

Telegrams: "SIMULTANE, BATH."
Telephone: 536 BATH.

At the end of the working week, all time cards are taken to the time office; and the total time and wages are filled in at the foot of each man's card. The total time and wages are then entered upon pay sheets, a representation of which is given in Illustration No. 7. It will be observed that they are ruled for four pays. The workmen's numbers, names, and rates of pay have thus only to be written out once a month, instead of every week as is usually the case when books are used—an arrangement which saves us several hours clerical labour each week.

We now want to ascertain that the wages to be paid are represented by work. Each workman gets a job card for each job he has to do (Illustration No. 2 shows that issued for a meter and

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NEWCASTLE-UPON-TYNE AND GATESHEAD GAS COMPANY.

DISTRIBUTION DEPT. No._____

PAY SHEET.

Standard Hours per Week—53. V—3735

Workman's No.	NAME.	Standard Rate of Pay. Week.	Day.	Hour.	Pay No. Week ended Time.	Overtime (after 9 p.m.)	Amount.	Pay No. Week ended Time.	Overtime (after 9 p.m.)	Amount.	Pay No. Week ended Time.	Overtime (after 9 p.m.)	Amount.	Pay No. Week ended Time.	Overtime (after 9 p.m.)	Amount.	Workman's No.
	Brought forward																

Illustration No. 7—size 13 inches by 13 inches.

service pipe); and on these are registered, by time-recording machines placed near the foreman's office, the times of commencing and finishing each job. Men working on inside work, while waiting for outside jobs, are generally employed on the same kind of work during such intervals; and therefore one job card for each class lasts the week. Regular jobs, such as loading and unloading of stores, testing meters, making solder, cleaning brasswork for stock, estimating, &c., are each given a separate but permanent job number, under which all work of this description is charged.

Very small outside jobs, the individual cost of which does not justify the labour of separate costing—such as attending naphthalene stoppages, turning on and off, cooker complaints, &c.—are also charged under separate, but standing, job numbers. As all time worked is recorded on job cards, this, when priced-out, should agree with the wages to be paid. The job cards for completed work, and those for jobs uncompleted on Thursdays (the end of our working week) are sent, as received, to the time office, where they are balanced with the money as shown by the time cards, which reveals whether any man has lost an unnecessary amount of time between jobs.

The procedure here is that, as batches of cards arrive, the clerks calculate the number of hours recorded, and their cash equivalent. They enter these in the spaces provided at the foot of the cards, and put the cards in racks similar to those previously described. There is one for each department—collectively having numbered slots for the cards of 900 men. The numbers are those already seen appearing on the time cards, pay sheets, job cards, and reports. Thus by the end of the week the whole of each man's job cards, which average about eight, are collected together. The cards are not only priced and balanced in this office, but also scrutinized as to excessive time on or between jobs.

The period between finishing one job and starting another is added to the former if not exceeding ten minutes. But if this time is exceeded, it is charged to a standing job number representing "Waiting for Jobs;" and the reason of the excess is inquired into.

Our works at Forth Street are divided into four chief sub-departments, each using several varieties of job cards suitable to the different classes of work dealt with. But no matter how numerous are the varieties of cards used in any one department, they are all of one distinctive colour. Thus the plumbing job cards are red; the mains department, blue; &c. This is to facilitate sorting operations preparatory to copying the time from the cards on to the wages abstract sheets.

The first step is to gather all the cards of each colour together; and this is where the utility of the device of having distinctive colours for the cards of each department shows itself—the sorting being done very quickly, and confusion between the departments prevented. The cards of each department are now arranged according to job numbers.

The next step in the process is to copy the time and wages from the job cards to the duplicate wages abstract sheets. (See Illustration No. 8.) Where two or more cards relate to the same job,

N. & G. Gas Co.

DISTRIBUTION DEPT.

WAGES ABSTRACT.

Form No. 154. *Pay No.*_____ *Week ended*_____ *191* .

25	6	7823	4	3	16	25	7830	17	9	1	17	7838	12	0															
150	6		3	0	131	25		10	6	157	17		7	2															
					21	17		12	0	168	9½		4	3															
	12		7	3	157	17		7	2																				
					332	7		3	2		43½	1	3	5															
					341	7		3	0																				
		7824																											
56	5		3	6		98	2	13	7			7840																	
65	7		5	0						13	7		5	0															
171	6		3	0						135	7		3	0															
190	5		2	3			7833																						
					7	5		3	6		14		8	0															
	23		13	9	176	5		2	5																				
						10		5	9																				
		7825																											
5	7		5	0			7834																						
15	5		3	6																									
136	7		3	0	56	53	1	17	6																				
191	5		2	3	171	53	1	5	0																				
	24		13	9		106	3	2	6																				

7823	12	7	3
7824	23	13	9
7825	24	13	9
7826	7	5	0
7827	10	7	1
7828	2	1	0
7829	4	2	1
7830	98	2 13	7
7832	9	4	4
7833	10	5	9
7834	106	3 2	6
7835	7	3	2
7836	9	4	8
7837	7	3	2
7838	43½	1 3	5
7839	2	1	0
7840	14	8	0
		£10 19	6

Illustration No. 8—size 13 inches by 9 inches.

they are entered at the left side of the sheet, together with the workmen's numbers, hours, and wages. The hours and wages are then added together, and the total transferred to the right-hand column. Where there is only a single card for a job, the particulars are carried direct into the right-hand column.

A separate abstract sheet is made out for salaries, and also summaries showing the total wages for each department; and the grand total agrees with the amount of wages paid as shown by the pay sheets. The abstract sheets are (on completion) placed in binders; one set being sent to the costs department of the chief office, and the other retained at the workshop for reference.

For the disposal of the job cards, we have the time and costs office fitted with a number of deep drawers divided into longitudinal sections. In these, the cards are filed away according to their job numbers. Each department has its distinct drawer; and on the outside there are indicators showing the contents of the section. Arranged thus, the cards are very easy of access; and we readily obtain any information we require.

STORES.

I will now describe our system as applied to that important item, storekeeping. In this respect, we are at a great disadvantage from the fact that the whole stores cannot be centralized in one building, owing to lack of space. We had thus to adapt our system to rather difficult conditions, which we met to a great extent by organizing various sub-stores, and placing the whole in the charge of a chief storekeeper.

Stores are obtained by requisition to the chief office, on receipt of which an order in triplicate is made out—one copy being retained at the chief office, and another sent to the firm supplying the goods. This latter bears a request for the invoice to accompany the goods; and if the invoice has not arrived by the time of the receipt of the goods, a post-card reminder is sent. The remaining copy is despatched to the workshop to which the goods are to be delivered; and on it is provided a space for the use of the storekeeper. In it, when the goods arrive, he notes their receipt, date of arrival, and the condition in which they are received. The form is then sent to the accountant's department with the invoice.

Where only a portion of the goods ordered are delivered, their receipt is entered on what is termed a supplemental goods received form and sent to the chief office with the invoice. When the whole order has been executed, the copy of the order is returned. Goods, having been received, are recorded on the left-hand side of stock cards with the cost, as obtained from the invoice.

Illustration No. 9 shows one of the stock cards. We have a few different rulings to suit various classes of goods. The issues of stores are recorded on the right-hand side. A separate stock card is kept for each description of article stored; and we have in current use altogether 4800 of these cards, which are stored vertically in cabinets. Each branch-shop has its own set.

Our materials are all classified; and the cards relating to the various articles comprised in each class follow each other in

N. & G. GAS. CO.	Form No. 117.	251370	MAX. STOCK.	MIN. STOCK.

RECEIVED INTO STOCK.						ISSUED FROM STOCK.									
Date.	From.	Order No.	Quantity.	Rate.	Amount.	Reqn. No.	Quantity.	Reqn. No.	Quantity.	Reqn. No.	Quantity.	Reqn. No.	Quantity.	Total Issued.	Balance.

Illustration No. 9—size 11 inches by 9½ inches.

sequence. The cards are also numbered consecutively for reference.

As to the issue of goods, these are all handed out by the storekeepers; and no other person is allowed to handle them while in stock or to go behind the stores counter. Neither is anything allowed to be supplied to anyone on a verbal request. The man who requires material for his job must write out a requisition (see Illustration No. 10) on which he shows the job

N. & G. Gas Co.. Distribution Dept. Forth Street.	STORES ORDER—METER FIXING. Form No. 120. 286494	No.
To the Storekeeper. Please supply me (Workman No.) with the following Meter and Materials:		Job No.

To be filled in by Storekeeper.	Meter.	Maker.	Maker's No.	Co's. No.		Reserved for Office use	
	Year Made.		Meter Reading.			Rate	Amount.
	Quantity.		Description.				

Date.....

This Card to be kept flat and clean. Storekeeper.

Illustration No. 10—size 6½ inches by 4 inches.

number and his own number. It is not found that there is any appreciable loss of time in the workmen having to do this small amount of writing; and it saves the time of the clerical staff.

The storekeeper, on the workman presenting his requisition, satisfies himself that the articles asked for are proper ones for the job. Having supplied them, he retains the requisition, from which the goods issued are posted to the issued side of the stock cards; and from the latter the cost is entered against the items on the requisition, and these are calculated and sent to the costing office daily.

Materials returned by workmen are shown on credit notes provided for the purpose; and these materials are entered on the received side of the stock cards without any price, and then dealt with in the same way as the requisitions. Old materials brought in from jobs are handed over to the storekeeper; a form for such being filled in and also dealt with in the costing office.

I may say that for prepayment installation stores we use, for convenience, the following requisition forms (Illustration No. 11) on which are shown the materials returned; and these, deducted from those issued, show the net. This saves credit-notes and consequent postings. This principle can be applied to requisitions for goods for other classes of work.

At the top of the stock card (Illustration No. 9) is a space for entering the maximum and minimum stock it is desirable to keep; and the storekeeper can easily tell how near he is approaching the minimum, and also what quantity should be ordered, as the state of the stock of any article can be ascertained from the cards. At the end of the half year, the received and issued columns of the stock cards are added up; the balance carried down; and the totals transferred to stock sheets. The actual stocks of stores, and the balances as shown by the stock cards, are entered on the same stock sheets and priced, and they should agree within narrow limits. If they do not, the matter is investigated.

Under this heading, I may mention two other items of charge against jobs; the first being cartage or motor traction. For this, way-bills are used—being made out to show the time occupied in delivering goods for the various jobs; the job number being quoted in each case. A copy of this is sent to the costing office for charging against the job; and a similar course is followed as to any expenses incurred which are chargeable against jobs.

ASSEMBLING OF COSTS.

We now arrive at the assembling of the costs of each job. We have seen the costings office supplied with the following particulars:—

1. A copy of the order and a report of the completion of each job.
2. A wages abstract, showing the wages chargeable against each job.
3. Priced requisitions as to goods issued and returned on each job, and from which an abstract is compiled similar to the wages abstract.
4. Charges for cartage or motor traction.
5. Chargeable expenses.
6. Notification on report of completion of job whether reinstatement of road is necessary.

As practically all reinstating is done by the local authorities, and we cannot get the charges in time to close-off the weekly sheets promptly, each reinstating charge is roughly estimated, and the whole account adjusted at the end of the half year.

From these particulars the following weekly sheets (Illustration No. 12) are made out in triplicate; a separate set being employed for each class of work shown. These are added up, and the totals of each carried to their respective accounts in the costing card ledger.

The cost account-keeping is on the double-entry principle, and closely related to the general accounts of the Company. For instance, the wages, as shown by the wages abstract (which it will be remembered is made up from job cards), are posted in the costs account to the debit of the respective jobs on the costing sheet just shown, and credited in one sum each week to a wages account. These, therefore, must balance; and they must also agree with the wages account in the general books, as obtained from the pay sheets made up from the time cards. The costing accounts supply the division of the items for the distribution headings in the general accounts.

It will be noticed that oncost is provided for in the weekly cost sheet. This is for indirect or establishment charges, but is only dealt with once a month.

Charges for work done are made up from these sheets. The Secretary, the Chief Engineer, and myself, are each furnished with one of the triplicate copies of the sheets.

SCRUTINY AND USES OF COSTS.

The objects of the system are to obtain expedition in carrying out work, to prevent waste, and to obtain an accurate method of allocation of expenditure. But this, like many other systems in business, merely provides the information, and it is by an intelligent use of such that the benefits are to be derived.

The weekly costing sheets show the cost of individual jobs, and the classified items of which the same is made up; and they are carefully examined. The costs of the several classes of jobs are averaged, and compared with those of the previous weeks; and the cause of any increase is inquired into.

A selection of jobs, the costs of which do not *primâ facie* appear unreasonable, is also made up; and these are gone into by way of additional scrutiny against waste, &c. The average cost of wages for prepayment installations is calculated each week; the

Face of Card.

N. & G. Gas Co., Distribution Dept., Diana Street.

STORES ORDER.
Prepayment Installation—Fittings.
Form No. 180. 290,133

Job No.

Stock Card No.	Materials. Description.	Issued.	Retd.	Used.	Reserved for Office Use. Rate.	Amount.
	Meter Fixing—					
	Meter					
	Padlock					
	Meter Cock					
	Brass Ferrules					
	Lead Pipe					
	Iron Tube					
	,, Bends					
	Cooker Parts—					

Stock Card No.	Materials. Description.	Issued.	Retd.	Used.	Reserved for Office Use. Rate.	Amount.
	Cooker or Griller Fixing—					
	Cooker					
	Lever Cock					
	,, Handle					
	Griller					
	,, Plate					
	,, Cock					
	Brass Ferrules					
	Lead Pipe					
	Iron Tube					
	,, Bends					
	Flue Pipe					
	,, Tees					
	,, Cones					
	,, Elbows					
	,, Damper					
	Cement Slab					
	Flooring Board					

Back of Card.

Stock Card No.	Materials. Description.	Issued.	Retd.	Used.	Reserved for Office Use. Rate.	Amount.
	Internal Fittings—					
	Pendants					
	Brackets					
	Pattrices					
	Burners					
	Iron Tube					
	Drop Screws					
	Hooks					
	Nails					
	Screws					
	Fine Solder					

Job No. _____

STORES ORDER.
Prepayment Installation—Fittings.
Form No. 180.

N. & G. Gas Co.
Distribution Dept.,
Diana Street.

To the Storekeeper. Please supply me (Workman No. _____) with the following Materials for the above Job:

To be filled in by Storekeeper.

	Maker	Maker's No.	Co.'s No.	Year Made	Meter Reading
Meter					
Cooker		Number			
Griller		Number			

Date _____ Storekeeper. _____

This Card to be kept flat and clean.

Illustration No. 11—size (when folded) 6 inches by 4 inches.

N. & G. GAS CO.

DISTRICT DEPT.
Form No. 179.

x—38

Office No.	Job No.	ADDRESS.	LABOUR. Hours.	LABOUR. Amount.	MATERIALS.	Stores.	Show Room	Chargeable Expenses.	Reinstating Street.	Cartage.	Total.	On Cost.	Total.	Estimate.	Charge.	Capital.	Revenue.	Remarks.

Illustration No. 12—size 16 inches by 10½ inches.

figures for the different branch workshops being compared. The cost of each street-main is examined and compared with others of similar diameter. Manufacturing receives special attention; the cost of production for each article or lot being gone into and placed against previous results.

There is not the slightest doubt that the system has effected many economies. The men are more punctual, as they are aware the recorders show the exact minute of arrival; and punctuality with a large body of men means a great amount of time saved. There is less waste of time between finishing one job and commencing another, and less frequent delays in the execution of orders, as at three points—viz., the office issuing the order, the orders and reports office, and the foreman's office—are provided means of keeping watch upon uncompleted jobs.

The comparative value of workmen is shown, and also where specialization of men is an advantage. There is better supervision and check on the stores; less stocks are carried; and delays are avoided by having to wait for material through the stock having run out unnoticed.

The foremen are informed of the cost of work done in their departments, which stimulates them to increased efforts towards economy; and the fact that workmen are aware that their jobs are the subject of investigation acts as a strong deterrent against wrong-doing, and the whole *morale* of our men is improved. The men took kindly to the system, and gave it a fair chance from the commencement.

Distribution departments of gas undertakings are places where job costing systems are of greater advantage than in many factories, because so much of the work is outside and consists of work engaging one or two men away from constant supervision

and not in gangs in charge of foremen on the spot to avoid waste. We have inspectors who visit jobs; but their visits are necessarily brief, and not always after the completion of the work. Therefore, you want to know the ultimate result in money.

A job costing system generally means extra clerical labour; but I have not known of any works where one has been introduced and afterwards discarded. The advantages are too great. The introduction of our system resulted in increased clerical staff; but this has been more than compensated for by savings and efficiency.

I recognize that the system I have outlined is for a distribution department dealing with a greater volume of work than that falling to the lot of most of the undertakings in the North of England; but it can be easily modified to suit businesses of smaller dimensions and different conditions, and the units of separate costs can be made whatever is desired. To set down in writing the details of the system makes it appear rather formidable; but in reality it is simple and runs smoothly. If any of the members of the Association desire further information, an endeavour will be made to satisfy their desires.

SHORT-SIGHTED POLICY.

The question of obtaining the best value for money (as the subject to which I have been referring undoubtedly is) constrains me to make reference to another subject in the same category—viz., the use of articles of good quality. In these times of strenuous competition, the buyer is often tempted to purchase goods which at first sight appear to be cheap and to meet requirements. But this is, too frequently, a short-sighted policy to be strongly condemned from a distribution point of view. The cheap article may suggest a momentary attraction; but for the commodity with which we deal, a good article at a fair price should always be the standard of purchase.

The cutting of prices, which necessitates relative reduction in value of the material and workmanship, ought to be discouraged by gas undertakings, and rather should encouragement be given to the manufacturer of a good article which will not develop any latent defects, no matter what part it is intended to serve, from the main to the point of consumption. If a piece of work is worth doing, it is worth doing well; and as good material and apparatus are essential to a good job, anything "cheap and nasty" should be rigorously eschewed.

A CENTRAL TESTING STATION.

In order to keep abreast of the times, it is the practice with this Company, as with many others, to obtain particulars of everything that is new, and in many cases to obtain a sample for testing purposes. But it is to be regretted that too often the articles are found to be of little or no commercial value; and in other cases they are imitations—and poor ones at that—of something already on the market.

This testing costs each concern a good deal of money; and I have long thought that if some means could be devised whereby all new appliances passed through some recognized centre for testing purposes, and the results were supplied to the undertakings contributing to its cost, it would tend to prevent a lot of inefficient apparatus being placed on the market, and there would be a great savng to the individual subscribers.

I quite realize that many difficulties present themselves against such a scheme; but if the broadening of the basis of the Institution of Gas Engineers, so commendably suggested by its immediate Past-President, is carried through, and there is a greater cohesion between traders and gas undertakings, some of these obstacles would not be nearly so formidable as they at present appear.

COOKER SIZES.

I would also like to draw attention to the question of the number of cookers the makers supply. If you take the list of any maker, I think you will come to the conclusion that there is not sufficient difference between the smallest and largest to justify the variety of sizes manufactured. Personally, I am of opinion that four sizes are ample to meet the ordinary requirements of the public; and if the demand were spread over this number (which could only be done by joint action), the makers should be able to make, and consequently sell, more cheaply—resulting in less rental being charged to the consumer, and, in turn, tending to increase the output. It would also be a decided advantage to gas undertakings if, by agreement, the dimensions of the ovens of the corresponding cookers of each maker were uniform, so that small parts—such as drip tins, shelves, grids, and possibly linings—were interchangeable, and thus reduce this stock of the parts to be kept. Improvements, however, even in small parts, should not be sacrificed for the sake of adhering to interchangeability.

MECHANICAL PUBLIC LIGHTING.

Members, meeting in a place where experiments with mechanical lighting of public lamps on a large scale are being carried out, will probably expect me to say a few words as to the progress of such experiments. It will afford me much pleasure to give the members such information as I may, consistently with the understanding between the parties concerned that information as to the working shall not be disclosed until the experimental period has terminated.

I am unable to say how long ago it is since the idea of automatically lighting and extinguishing public lamps was first conceived; but it is on record that a Mr. Butcher experimented in the streets of Newcastle in the year 1885, with an apparatus of his own invention. The Butcher apparatus was composed of a metal chamber, containing two small holders sealed in mercury, one of which merely acted as a governor and controlled the bye-pass while the pressure was in action. The other holder contained an inverted cup of such depth that, under normal conditions, the gas-way to the burner was sealed and shut off. When the pressure was applied, the holder rose and allowed gas to pass to the burner; and, on the pressure being removed, it was held in position and prevented from falling by a rack-and-pin arrangement inside the holder. The next wave of pressure at extinguishing time caused a further operation in the rack, and allowed the holder to drop and seal the way to the burner—thus shutting off the gas.

In April, 1903, experiments were commenced with clockwork on 100 lamps in Jesmond; but these were discontinued after a period as the Newcastle Corporation were not then disposed to entertain mechanical lighting.

In May, 1907, experiments were commenced with the pressure apparatus of the Bamag Company, when 82 lamps were fitted up in certain streets near the governor-house. The experiments ceased after six months working, as it was considered that before any final decision was come to as to the desirability of the general adoption of a system of pressure lighting, an experiment should be carried out at a considerable distance from the governor-house.

The Gosforth Urban District Council were approached in October, 1907, for permission to fit up the whole of the 500 lamps in their district with "Bamags." This was readily granted, and they were fitted up and first operated in February, 1908. They are still being operated.

The lighted area consists of twenty miles of streets; the first lamp being at the point where the district joins the City of Newcastle, two-and-a-half miles from the governor-house, and the furthest lamp an additional one-and-a-half miles away.

At the commencement of the experiment, the higher pressure required to actuate the apparatus at this distance was allowed to pass through the whole of the Company's distributing mains on the north side of the Tyne; but, as this was considered to be inadvisable, the main feed to Gosforth was isolated, and the extra pressure confined to that district.

The whole of the lamps are looked after by two attendants, who are provided with special bicycles carrying a light folding ladder, and a holder for a small supply of mantles, &c. They inspect the lamps both at lighting and extinguishing times, and attend to any failures there may be—making a note of same for inclusion in their report to the office. These men also clean the lamps; the whole of their beat being covered once a week.

The number of failures is comparatively low—about 5·74 per actuation, chiefly due to naphthalene stoppages on the service pipes. At one time bye-passes gave a certain amount of trouble, from the fact that they were blown out whenever there was a wind velocity of anything approaching 25 miles per hour. As wind-storms of this and even greater speeds are often experienced in our district, we were obliged to carry out experiments, resulting in the adoption of a cup form of bye-pass, which has proved so efficient that we are now rarely troubled with the bye-passes becoming extinguished unless in extremely bad or hurricane weather.

The installation has afforded complete satisfaction to the District Council; and I believe they are prepared to take it over permanently. But we have thought it advisable to defer the question until the completion of the further experiments I will now refer to.

FURTHER EXPERIMENTS.

In November, 1909, in accordance with an arrangement with the Lighting Committee of the Newcastle Corporation, three systems of 250 lamps each were installed within an area about a mile from the governor-house. These consist of—

Alder and Mackay	Pressure apparatus
Bamag	do. do.
Horstmann	Clockwork do.

It was decided that the experiment should continue for twelve months, and in the sole charge of the Company; the makers taking no part whatever in the working. Each installation is looked after by one man only, who cleans the mantles, &c., as at Gosforth.

As I have already intimated to you, I am not in a position to furnish at present any information with respect to the working of this experiment; but, when concluded, a statement of the results will probably be prepared, and this will be available to such of the members as are interested in the subject. I may, however, without any indiscretion, state that, so far as the experiments have gone, the general results are very satisfactory in each system; and, further, that in my opinion the feasibility of pressure lighting has been established. But under certain conditions it is not desirable to operate apparatus over large areas where district governing does not exist, or where the cost of its installation is prohibitive. In such cases, the difficult portions of the area can be operated by the clockwork system.

As might be expected—conditions being required which were never anticipated in the arrangement of the mains—many difficulties have arisen during the whole of the experiments, most of which steady determination has enabled us to mitigate if not entirely remove.

In conclusion, I think it ought to be mentioned that the Special

Purposes Section, which, at your last meeting, you authorized to be commenced, is now an accomplished fact. I am sorry more undertakings have not as yet intimated their intention to nominate representatives; but there is no doubt that the benefits to be derived by those who have already joined the section will be such as to induce increased membership. The more opportunities we have for the interchange of ideas, and for agreeing upon uniformity of methods (as hinted at in the course of my address), the more the industry has to gain.

Mr. T. H. DUXBURY (South Shields) proposed a hearty vote of thanks to the President for his able and lucid address. He said the President was not only a fully qualified gas engineer, but having specialized in gas distribution work under what he would suggest was one of the most enterprising gas companies in the whole world to-day, he held a unique position; and of his knowledge and ability he had given them proof that morning.

Mr. H. TOBEY (Malton), seconding, said that in Mr. Lewis they found a most excellent President. He had given them an address which must be of considerable value to every gas company. Of course, in the case of a company with something like 110,000 to 120,000 consumers, it was necessary to have a system of working; and that the system which had been devised by Mr. Lewis, and which he had expounded to them, showed them that they were working out the thing in a most elaborate and satisfactory manner. Smaller concerns, no doubt, did not require such a system as this; but still, he thought, they would find, if they would look at the address, that if they would take a few hints from it, the scheme would be a valuable one, and might be adopted even by smaller concerns. Presidential addresses, and the papers read as well, enabled them to see what was being done by others, and to gather from other people's experience what would, perhaps, be of great use to them in their own works. They were also indebted to the President for the very interesting excursion they had made that morning round the Elswick Ordnance Works. It was an interesting visit. They had had brought before them a great many things which some of them did not often have an opportunity of seeing—things which somewhat astonished them, in the magnitude of the work and the appliances for carrying out that work.

The PRESIDENT, acknowledging the vote of thanks, said he was pleased to hear there was a certain amount of value in his address. His one aim had been to give them something which might be useful; and if this object had been achieved, then, of course, the pleasure was his.

This concluded the business of the meeting.

EXCURSION AND DINNER.

The company afterwards sailed from the Quayside to Tynemouth, where, at the Bath Hotel, they were entertained to dinner by the Newcastle and Gateshead Gas Company—Mr. W. SUTTON, J.P., one of the Directors, presided over a company of about 130.

The CHAIRMAN proposed "The North of England Gas Managers' Association," and in doing so said he was pleased to know that the Association had its origin and its inception in the Newcastle and Gateshead Gas Company's offices. The late Mr. W. Hardie had an active interest in the gas industry, and over and again he had the officials of various gas industries about Newcastle with him in his office discussing the best way of doing things. He was sure that this irregular and informal way was very much improved by the Association which they now had. The Association had had in the past three of their esteemed officials as President—Mr. W. Hardie, Mr. Doig Gibb, who was with them that day, and whom they were very pleased to see, and would always be pleased to see in the North of England, and Mr. Thomas Hardie, now their Chief Engineer. Now they had—and he took it as a compliment to the Company—Mr. Lewis, their Distributing Engineer, as President.

The PRESIDENT, in acknowledging the toast, referred to the proposal to change the day of the meeting, and said that the Committee were not taking a vote upon the subject, but wished to ascertain what might be the wishes of the members. Before anything was done, the matter would be brought before the Association. The Special Purposes Section had commenced extremely well. It was undoubtedly going to do a great work, which was only natural, seeing that while the Association met only twice a year the Special Purposes Section would meet monthly. As yet they had only had one meeting, at which their worthy Secretary, Mr. Lees, introduced a subject which affected not only that district, but the industry generally. This was, he expected, the forerunner of many other important subjects which would come before them for discussion, and for the benefit of the industry. They required more members for the carrying on of the section successfully; and he felt certain that when the full benefits were comprehended, they would get these members. In the meantime, those who were not members were losing good material.

Mr. H. TOBEY proposed "The Chairman and Directors of the Newcastle and Gateshead Gas Company," to which the CHAIRMAN responded.

Mr. F. P. TARRATT (Darlington) proposed "Kindred Associations." This was responded to by Mr. J. BOND, of Southport, as representing the Manchester District Institution of Gas Engineers.

Mr. W. DOIG GIBB (London) proposed the toast of "The Chairman." He wished to say how much he was gratified to be once more among them.

The CHAIRMAN briefly returned thanks; and the proceedings terminated shortly before five o'clock.

The late Mr. Mark Archer, Managing-Director of the Holmside Collieries, Durham, and of the South Moor Colliery Company, Limited, of Newcastle-on-Tyne, whose death was announced in the "JOURNAL" for the 16th of August, left estate of the gross value of £96,906, with net personalty amounting to £90,727.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

On an invitation from Mr. E. Pilbrow, the Superintendent of the Joint Gas Companies' Exhibit at the Japan-British Exhibition, members of the London and Southern District Junior Gas Association, to the number of about sixty, on Saturday afternoon visited Shepherd's Bush and, after inspecting the excellent show of up-to-date gas appliances to be seen there, were entertained at tea in the Garden Club. Mr. F. W. Goodenough, Controller of the Gas Sales Department of the Gaslight and Coke Company, had consented to preside at the tea; and, on being asked to address the members, he did so. Those present greatly appreciated Mr. Goodenough's remarks, and altogether the afternoon was thoroughly enjoyed.

Mr. L. F. Tooth, the new President of the Association, proposed a hearty vote of thanks to Mr. Goodenough for giving them a few of the scanty moments he had to spare; and with this he coupled the name of Mr. Pilbrow. Mr. D. J. Winslow seconded the proposal, which was supported by Mr. W. J. Liberty, who said they had had the clearest evidence that Mr. Goodenough took a very lively interest in the affairs of the Association. The vote having been carried with applause, Mr. Goodenough, in acknowledgment, remarked that Mr. Liberty was perfectly right in saying that he (the speaker) took very great interest in the Association, and in all the young men engaged in the gas industry. Mr. Pilbrow also returned thanks.

MANCHESTER UNIVERSITY LECTURES ON GAS.

An intimation is to hand—signed by the Vice-Chancellor of the University of Manchester (Sir Alfred Hopkinson) and the Professor of Chemistry, Dr. Harold B. Dixon—giving particulars of the two courses of lectures arranged for the present session, in consequence of the movement originated by the Manchester and District Junior Gas Association, and supported by the Manchester Institution of Gas Engineers, for promoting scientific work in the University by those interested in the gas industry.

First of all there has already started an inaugural course of six lectures, on the science of gas manufacture and combustion, of which the following is the

SYLLABUS.

Oct. 1, 1910.		"Chemistry of Gaseous Combustion," Professor Harold B. Dixon, M.A., Ph.D., F.R.S., President of the Chemical Society.
Nov. 5	„	"Internal Combustion Engines," Dugald Clerk, Esq., F.R.S.
Dec. 3	„	"Carbonizing," Harold G. Colman, Esq., D.Sc., Ph.D.
Jan. 1, 1911.		"Construction as applied to Gas-Works," Charles Hunt, Esq., M.Inst.C.E., Past-President of the Institution of Gas Engineers.
Feb. 4	„	"Chemical Control of Gas-Works," J. T. Sheard, Esq., Chief Chemist, Sheffield United Gas Company.
March 4	„	"Pyrometry," J. A. Harker, Esq., F.R.S., of the National Physical Laboratory.

The lectures are given in the Chemistry Theatre of the University at 3 p.m., and admission is free to all interested in the gas industry, on presenting a ticket to be obtained from the Hon. Secretaries of the District Associations (Mr. W. Whatmough, Gas-Works, Heywood, or Mr. J. Alsop, Laymarice, Edgeley Road, Stockport), or from the Registrar of the University.

Then there is to be an advanced course of twelve lectures and demonstrations on the chemistry of gaseous fuel and flame, designed for those who have already acquired a knowledge of gas manufacture.

SYLLABUS.

Kinetic Theory of Gases. Pressure of Condensable Vapours. Nature of Chemical Change. Flame and its Structure. Theory of Luminous and Non-Luminous Flames. The Ignition Points and Specific Heats of Gases. Temperature of Flames. Phenomena of Explosion in Gases. Pyrometry. Standardization of Thermo-Junction Pyrometers. Constant Temperature Furnaces. Calorimetry. Preparation of Pure Gases. Manipulation and Analysis of Gases. Theory of Fractional Distillation and Condensation.

These lectures will be given by Professors Dixon, Carpenter, and Petavel, Dr. Lapworth, Dr. Norman Smith, and other members of the staff. The first will be held on Monday, the 17th inst., at 7 p.m.; and the fee is £1 1s. for the course. It is expected that some of those attending this course will undertake research work in connection with gas problems.

Arrangements have been provisionally made for the annual meeting of the Yorkshire Junior Gas Association to be held on the 15th inst., when Professor Cohen, of the Leeds University, has promised to lecture on "Smoke."

At the meeting of the Lancaster Town Council last Wednesday, the resignation of Mr. J. C. Mount, Assoc.M.Inst.C.E., who has held the position of Borough Surveyor and Water Engineer for 25 years, was accepted with regret.

WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.

Half-Yearly Meeting at Newport.

AGAIN favoured with fine weather, the Institution last Wednesday held their September meeting at Newport (Mon.), with whose gas-works the new President, Mr. J. H. Canning, is connected. It was the second visit of the members to the town; the previous meeting there having taken place in 1906, during the year of office of the first President of the Institution—Alderman Thomas Canning, the Engineer and Manager of the Gas Company. On their return, they still found a progressive gas undertaking much more than holding its own against municipal electricity. Those who arranged to stay during the evening were able to inspect numerous excellent examples of outside lighting by means of incandescent gas, and numerous startling examples of shop window lighting by the aid of particularly aggressive flame arc lamps, some of which are placed almost in the line of vision of those who pass them. When one sees a diminutive shop window under the glare of three or four flame arc lamps, curiosity as to the cost will manifest itself. If the Newport shopkeepers who favour electricity pay a commercial price for their current, the lighting bills of some of them must be fairly heavy; and if they do not pay a remunerative rate, who makes up the difference? It is, of course, a fact that electricians have sometimes fearful and wonderful methods of charging which are of so complicated a nature that people have considerable difficulty in finding out what they do pay. Whether or not this has been the case at Newport, we will not stop to inquire. It is, however, common knowledge that an expert was lately called in to advise upon the present position of the Corporation electricity undertaking; and that, on the strength of his report that they were selling the current too cheaply, the authorities have recently had to raise the price. There is in this the comforting reflection to those who use the Newport streets that it should not tend to further popularize the use of big flame arc lamps for the outside lighting of little shop windows—or of any shop windows at all, for the matter of that. That the business of the Gas Company is conducted in an enterprising manner, no one who knows Mr. Canning will doubt, and no one who has visited Newport will need to be told. The excellent installations of outside gas lighting that are to be seen have been referred to; and the members had a good example of indoor work in the Savoy Hotel, where luncheon and tea were partaken of at the invitation of the Directors of the Gas Company. Here the whole of the lighting, cooking, and heating is carried out by means of gas. The building is lighted on the high-pressure system; there being 176 burners, yielding a total illumination of close upon 24,000-candle power. Cooking is carried out by a modern and complete set of apparatus in the main kitchen; while, in addition, grillers, water-heaters, and other auxiliary appliances are fixed at various points in the establishment in order to meet the demands of the extensive business carried on. Then the building is heated throughout by gas-fires and radiators; the former being enamelled to harmonize with the general colour-scheme of the respective apartments. The Company have a handsomely-fitted show-room opposite the tram-centre in the town, where an extensive stock of gas fittings and apparatus is maintained. A compressor driven by a gas-engine is installed here, and supplies, besides the outside lamps at the show-room, a great number of shop-lamps in the neighbourhood. With other South Wales towns Newport has, of course, been feeling the effects of the unrest in the coalfield; a number of contracts from abroad having been lost on account of the uncertainty of being able to get the coal. It is, however, pleasant to learn that now things seem to be improving; and thus the town and the Gas Company have both before them every prospect of continuing to progress. That this may be the case will be the earnest wish of all the members of the Institution—and particularly of those who were able to take part in Wednesday's proceedings. The Chairman of the Company (Dr. H. Melvill Brewer), the Directors, the Secretary (Mr. T. H. Hazell), and, of course, Messrs. Thomas and J. H. Canning, left nothing undone to make the day a thoroughly successful one. The welcome extended to them will long be remembered by all who attended the meeting.

THE BUSINESS MEETING.

When the members assembled in the Gas Offices (which had been placed at their disposal for the meeting by the Directors of the Company), the chair was taken by Mr. A. H. BROOKMAN, Engineer and Manager of the Tenby Gas Company, who was the retiring President.

A WELCOME.

Before the business was entered upon,

Dr. H. MELVILL BREWER, the Chairman of the Newport Gas Company, extended a hearty welcome to the Association. He said he trusted the accommodation would prove to be what they required, and that the deliberations of the members would be satisfactory. He hoped they would be able to form some plan by which to obliterate electric lighting altogether. (Laughter.) Later on at the luncheon, he would see them again.

MINUTES OF THE LAST MEETING.

The HON. SECRETARY (Mr. Octavius Thomas, of Pentre) read the minutes of the meeting held last May at Cardiff; and they were confirmed.

THE LATE KING.

The HON. SECRETARY then read a letter from Mr. Winston S. Churchill in the following terms: "I am commanded by the King to convey to you hereby His Majesty's thanks for the loyal and dutiful resolution of the members of the Wales and Monmouthshire District Institution of Gas Engineers and Managers on the occasion of the lamented death of His Late Majesty King Edward VII. I am to say that the expression of sympathy with Queen Alexandra has been laid before Her Majesty, who desires me to communicate to you her thanks."

REGRETS FOR NON-ATTENDANCE.

The HON. SECRETARY intimated that letters expressing regret at inability to attend the meeting had been received from, among others, Mr. Alexander Wilson, of Glasgow, the President, and Mr. R. G. Shadbolt, of Grantham, Vice-President, of the Institution of Gas Engineers.

NEW MEMBERS.

Two new members were elected—Mr. Henry Downing Hazell, Distributing Engineer at the Newport Gas-Works; and Mr. William Bernard Mimmack, Engineer and Manager of the Pembroke Docks and Town Gas Company.

THE NEW PRESIDENT.

Mr. BROOKMAN said the time had now come for him to vacate the chair; and he had the pleasure of introducing their friend Mr. J. H. Canning, who would fill the vacancy. Mr. Canning was a gentleman who had given proof of his ability to deal in a masterly manner with questions affecting both gas and electricity. The members would agree that he would fill the chair, not only with distinction to himself, but with credit to their Institution and to the industry in general. He asked them to accord Mr. Canning a very hearty welcome.

Mr. CANNING (after having taken the chair, amid applause) thanked the members for the cordial manner in which they had received him, and especially Mr. Brookman for the kind and totally undeserved remarks he had made.

THE RETIRING PRESIDENT THANKED.

The PRESIDENT said his first duty was a pleasant one—namely, to propose a hearty vote of thanks to Mr. Brookman for the able manner in which he had filled the presidential chair. The Institution had now had a number of Presidents who had all of them sustained the position with dignity; and he was sure that Mr. Brookman was second to none in the way he had carried out the duties.

Mr. R. A. BROWNING (Neath) seconded the vote; expressing his full concurrence with all that the President had said.

The vote having been carried with applause,

Mr. BROOKMAN acknowledged it. He was afraid, he said, that he could not lay claim to have done very much, though he would have liked to be able to do so. He could only say that the work attached to the presidency of this young Institution had been a very great pleasure to him. Unfortunately, distance had prevented him from attending all the meetings; but he had done his best to maintain the prestige of the Institution, which he sincerely hoped might long continue to make progress.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—In the first place, permit me to thank you most heartily for the great honour you have done me in electing me your President—a distinction I owe purely to your kindness and to no merit of my own. But I am confident that you will extend the same kindness so far as to overlook my shortcomings in the discharge of the duties of this high office. In view of the numerous and admirable addresses delivered in recent years by the Presidents of Associations connected with our industry, I feel it

would be hopeless to aim at originality or novelty in anything I may attempt to put before you, especially as what little I might say has been so much more ably presented, and so much better expressed, by others. It is my purpose therefore to deal very shortly and simply with a few phases of the modern developments of the gas industry.

THE RESTRICTIONS ON GAS SUPPLY.

For sixty or seventy years following its inception, gas, possessing as it did an almost complete monopoly of the field for lighting, made great material progress; but the incentives to invention and the development of the use of gas for other purposes than lighting were altogether lacking. At the same time Parliament imposed rigid obligations and restrictions upon gas undertakings; and under the circumstances of the time, these safeguards no doubt fulfilled a useful purpose. To-day every condition under which gas supply was heretofore carried on has changed; and the gas industry is practically in the same relation to the public as the great bulk of commercial undertakings, inasmuch as it obeys with them the laws of competition, and of supply and demand. Differences are, however, still apparent. While many of the restrictions framed to meet conditions no longer existing still remain, Parliament has, in the public interest, very wisely removed or relaxed a few of these checks to progress. Of those still in force, there are many whose careful revision would be most decidedly to the public advantage; and the united action on the part of gas undertakings to procure such a revision of the General Acts applying to our industry would at the same time both enable competition to be better encountered and benefit the consumer. This point may be urged with the greater freedom inasmuch as the fierce competition in which we are engaged completely eliminates the necessity for many of the old safeguards, the removal or relaxation of which would certainly result in ultimate benefit both to the industry and to the public. There is another marked difference. During the past few years, the prices of most articles of popular consumption have materially advanced, among others that of coal—the raw material of gas manufacture. In spite, however, of the considerable advance in the cost of coal, the price of gas generally has not been advanced, as the benefit of economies effected by means of improved methods of manufacture has been transferred to the pocket of the consumer.

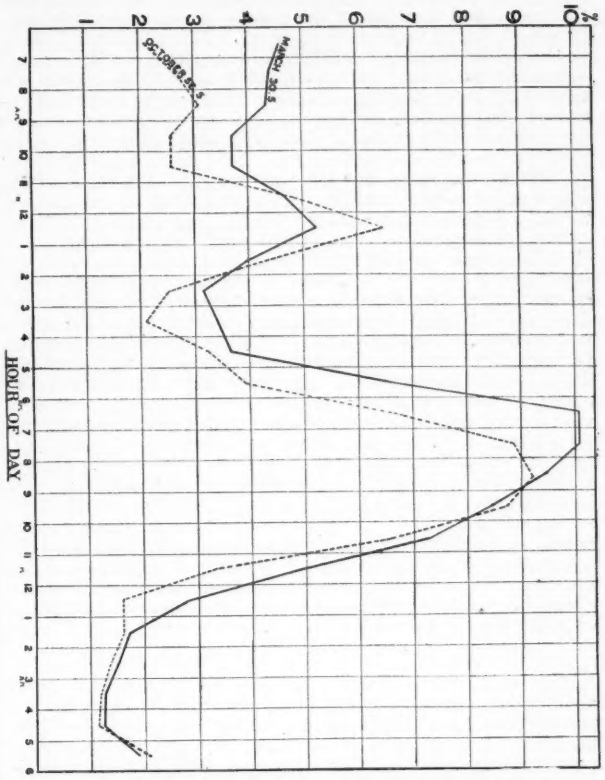
MODERN ADVANCES IN GAS SUPPLY.

The most striking, however, of all modern changes in the industry has been the great development in the use of gas for heating and cooking purposes. The incandescent gas-burner brought about, of course, a great revolution in an already existing field—that of lighting; but the application of gas for heating and cooking is more epoch-making still, in that it has opened up an absolutely new sphere of action, and one, moreover, to which gas is eminently well adapted. In the earlier days of gas lighting—the output being determined by the regular seasonal variations in the length of day and night—it could be very accurately predicted for any given period of the year; a heavy winter fog being practically the only disturbing element. At the present time, however, the erratic variations of temperature possess a great and increasing influence upon both the absolute quantity and the distribution in time of the output of gas.

You are all familiar with the elementary facts of the increase of the heating load (if I may borrow this term from our competitors) during periods of low temperature, and the part played by hot weather in stimulating the demand for gas for cooking purposes. But it is somewhat difficult to ascertain to what extent these influences are operative. This difficulty may to some extent be got over by comparing the hourly output of gas during each of two periods of the year during which sunset takes place at nearly the same hour, but the temperatures of which differ considerably. Probably two of the most suitable periods for this purpose are the days around March 1 and Oct. 1, more especially as our fickle English spring often affords the maximum intensity of cold for the year. This was noticeably the case in 1909, when the average temperature of the week ending March 6 was 30·5° Fahr., and that of the week ending Oct. 2 56·5° Fahr.

The diagram exhibits the average hourly output of gas during each of these weeks expressed as a percentage of the average daily output over the same period. The most cursory examination of the diagram at once reveals the fact that the lighting load is overwhelmingly predominant. It is well that attention should be directed to this point, as there is a disposition in some quarters to assume that gas has been relegated to the status of a heating agent pure and simple. It is clearly evident that there is not a shadow of justification for this gratuitous supposition. The very marked influence of the meal hours is clearly visible upon both curves, but far more distinctly upon the October curve, where the breakfast, dinner, and tea hours are distinctly indicated. It may even be conjectured that the elevation of the October curve beyond the March curve between 9 p.m. and 10 p.m. is due to a demand for gas at supper time at a season when, owing to the mildness of the weather, kitchen ranges are not in use.

The effect of cold weather in bringing into use gas-fires and other heating apparatus is evident over the whole length of the March curve, but more particularly in the early morning from 6 a.m., to 8 a.m., and again on the approach of the colder hours of the evening, from 5 p.m. to 8 p.m. The rapid decrease in the heating load after 8 p.m. is, of course, largely due to the closing of business establishments, and also incidentally seems to indicate that cold weather induces retirement to bed at an earlier hour than that usual in normal weather. In general, this rough diagram indicates plainly that, while gas is increasing in favour for heating and cooking purposes, it is still more than maintaining its ground as a lighting agent; and this naturally leads to an inquiry as to the most suitable methods to be adopted in order both to retain and to add to this business.



Hourly Output of Gas expressed as a Percentage of the Average Daily Output.

THE PUSHING OF GAS SALES.

Advertising and canvassing have been largely resorted to for some years past, not only by suppliers of gas and electricity, but also by the firms supplying lamps, burners, fittings, heating and cooking apparatus, and the thousand and one adjuncts made use of in either industry. Many of the advertisements issued on behalf of electrical manufacturers have not been conspicuous for strict scientific accuracy; and it would, perhaps, be hypercritical, taking everything into consideration, to expect it. But it is very essential that the interests of the gas industry should not suffer in consequence of any failure on our part to correct erroneous conclusions which the public may be led to draw from these widely disseminated statements, and at the same time that the case for gas should be laid fairly and adequately before the public. This work has hitherto been undertaken by a few public-spirited gas companies; but it is certainly full time that the industry at large should combine its forces with a view to meeting this phase of competition. Very much may also be accomplished by local bodies similar to the General Purposes Section it is proposed to form in connection with this Association.

Judicious canvassing and the establishment of a well-kept show-room are very powerful aids to the retention of existing business and the acquisition of new. In connection with these matters, however, there is one point of such overwhelming importance that very special stress may be laid upon it. It is the undoubted fact that unless burners, cookers, and other apparatus are regularly and carefully maintained, the solicitation of new orders is useless. As precept is vain without practice, so also is canvassing without maintenance. At the present time, gas undertakings are prepared to carry out the work of maintaining incandescent lights at such a nominal cost that it is to the advantage of every consumer to place his burners in their hands, as this procedure will result in his obtaining a far better light, in the majority of instances, than he could secure otherwise. Many consumers maintain their own burners, and do so excellently. It would be well if all consumers could do so; but this is a counsel of perfection, and one which want of time and numerous other reasons render it impossible for most people to follow. Cookers on hire should also be regularly inspected and cleaned, as this attention goes a long way towards popularizing the use of these valuable domestic adjuncts. In order, however, that this maintenance work shall be carried out efficiently, it is essential that the outside staff of all gas undertakings shall be thoroughly up to date in all that appertains to their business.

THE OUTDOOR STAFF AND ITS WORK.

Considering the very rapid change that has taken place in the methods of lighting and heating by gas during the past few years,

it is remarkable that the rank and file of the industry have shown such ready adaptability to modern conditions. But every day the apparatus employed and the principles involved become more technical, more scientific; and it is absolutely necessary that those engaged in fitting and maintenance work, which in itself has now become a great industry within an industry, should be afforded the opportunities necessary for obtaining a sound knowledge, both theoretical and practical, of the principles and methods forming the foundation of their every-day work. The outdoor staff are in one important respect on a different footing from the indoor staff. While the latter have always a superior at hand to consult in a case of difficulty, the former, while still under the general direction of the engineer, are bound, from the very nature of their work, to frequently encounter difficulties which they must rapidly solve for themselves upon the spot. It is essential, in the interest of both the consumer and the employer, that the fitter should arrive at the correct solution. This he cannot do unless he is thoroughly grounded in all that relates to his work.

It may not therefore be out of place here to make an appeal to all those connected with the direction and management of gas-works in this district to assist by every means in their power the classes which your Council are now about to arrange for the efficient teaching of all those engaged on the outdoor staff of gas undertakings. The importance of the work is manifest from the fact that the American Gas Institute and many large electrical firms in that country have vigorously taken up this work of educating their employees; while in our own country several of the District Associations are now engaged in preparing schemes for classes. It is manifest that, if we are to introduce successfully the most up-to-date and scientific appliances and fittings, those in charge of the fitting and working of such apparatus must be thoroughly qualified men; and as there are at present no means in this district whereby gas-fitters and others may acquire the necessary knowledge, it is a duty devolving upon all who have the interest both of the public and our industry at heart to assist in providing adequate facilities for those who are desirous to become qualified. The alternative is, of course, the absolute abandonment of modern methods, which is absurd.

COMPETITION OF GAS AND ELECTRICITY.

Even at the risk of repeating what is probably familiar to you all, it still appears to be desirable to refer briefly to gas in its relation to public lighting. It has been stated in all seriousness that the competition of gas with electricity for public lighting purposes no longer exists. This is true as regards a few municipalities owning their own electrical undertakings, and it is also true in so far that it is competition, and not gas, that has been extinguished; for the undoubted superiority of gas for public lighting, both as regards economy and efficiency, has been proved up to the hilt repeatedly during recent years. There is no one here present who does not, I am sure, admire those who give their time so ungrudgingly to the public service, and who transact municipal business with such ability and, generally speaking, with such impartiality. But as even Homer has been observed to nod, so it is to be feared that municipalities owning electrical undertakings occasionally incline their heads and hearts to their own offspring regardless of the expenditure involved. This is very natural—in fact, the usual argument adduced in support of such methods is that the electricity concern being the ratepayers' own property, the public lighting should therefore, as far as possible, be carried out electrically.

This argument appeals rather to sentiment than to reason. Still, in spite of this, we may assume its validity for present purposes. But even if it be the wish of the ratepayers to use their own commodity, they have a right at least to be informed of the cost involved as compared with that of other methods of carrying out the same lighting. This may easily be obtained by means of a system of open tendering, such as is usually adopted both in London and in many provincial boroughs; and such a method of procedure at once enables the public to judge of the propriety or otherwise of carrying out the policy above indicated. Still, there are many independent and competent authorities who do not admit for a moment that the argument above quoted should have any weight whatever. They say, and with some reason, that, in view of the burdens that are already borne by the ratepayers, the cheapest method of lighting should be adopted, provided it is efficient. Electricians make answer that, though they are a little dearer, yet gas cannot compare in efficiency with electricity for public lighting.

Even at the risk of further repetition of that with which you are acquainted, let us now proceed to examine some facts. This year the Westminster Borough Council invited tenders for the provision of a certain definite quantity of light in certain portions of their district. It is to be particularly noted that this entirely disposes of the question of relative efficiency. The Westminster Council are not buying energy, whether gas or electrical, neither are they paying for lamps of any certain nominal candle power. They are buying light pure and simple; and it is immaterial to them whether such light be produced by gas, oil, electricity, or any other agent whatsoever, provided that the light furnished complies with their requirements as to quality and quantity. What has been the result of the tendering? You are, of course, all aware; but the figures are worthy of careful study by all interested in public lighting. The respective tenders were:

Gas	£13,800 per annum.
Electricity	£21,800 ,,

These figures need no comment. A saving of £8000 per annum, being an economy of over 36 per cent., speaks for itself. The consequence has been that Westminster has, after a long experience of electricity, returned to gas for public lighting purposes. And this is no specially selected case. It happens simply to be the latest of a long series. Any visitor to London may view for himself the magnificent gas lighting in Aldwych, Kingsway, Fleet Street, and many other leading thoroughfares which are now being illuminated by gas solely upon the homely, but sound, commercial grounds of efficiency and economy.

The foregoing remarks only imperfectly deal with the question of non-competitive public lighting in reference, chiefly, to the point of view of the ratepayer. There is another aspect more personal to ourselves, and it is the indirect injury done to the reputation of gas as a lighting agent. The general public, having no means of arriving at the facts, and seeing electricity largely substituted for gas in the streets of a borough, are apt very naturally to conclude that this is the result of competition, and that gas is outclassed. Of course, when the facts are known, this impression is at once removed. It is therefore incumbent upon those connected with our industry not to tacitly acquiesce in a public depreciation of gas, but to publish as widely as possible the circumstances, in order that the public may not be led, under a complete misapprehension, to consider that gas is unable to compete with electricity for public lighting. As a matter of fact, gas is easily first in the field of public lighting; and it may be confidently stated that the finest examples of street lighting in the world are those carried out through its agency.

A PROMISING OUTLOOK.

A brief review, therefore, of the past few years in the history of the gas industry can but fill us with the strongest hope and confidence for the future. Most of us here present have during that period seen this great business, which to all appearance seemed to have settled down to vigorous, settled, and conservative maturity, resume more than the full vigour of youth, develop new fields of enterprise, utilize to the full the resources of modern science, and successfully cope with the onslaughts of a formidable and vigorous competitor—one, moreover, endowed with all the prestige and optimism of youth. These are happy auguries for the future; and great as has been the past history of our industry, we may confidently look forward to greater developments and far more extended fields of enterprise in years to come.

At the conclusion of the address,

Mr. BROOKMAN proposed a vote of thanks to the President. He felt sure the members would agree with him that the address was bristling with suggestions and useful advice which they might all of them well take to heart. He was glad that Mr. Canning had devoted the greater part of his address to the question of distribution, because he thought this was a side of the industry which had been somewhat neglected—especially the subject of maintenance and the upkeep of different apparatus by which gas was being used. This was one of the most important matters that any Institution could deal with.

Mr. H. D. MADDEN (Cardiff) seconded; remarking that the address would be most useful on the records of the Institution.

The vote of thanks having been enthusiastically accorded by the members,

The PRESIDENT, in acknowledgment, said the address could lay claim to no originality, but he thought he might say it dealt with a few points which required earnest attention at the present time.

A SPECIAL PURPOSES SECTION.

The PRESIDENT remarked that they had a long programme to get through; and the next item on the *agenda* was "To consider, and, if approved, pass, the rules of the Special Purposes Section." If any members would like to ask questions or make suggestions with regard to these rules, he would be pleased to hear them.

The rules were as follows:—

THE SPECIAL PURPOSES SECTION RULES.

1.—The object of the section shall be to deal with such matters relating to the interests of the gas industry as shall from time to time be deemed desirable by the members of the section.

2.—Membership of the section shall be open to any gas undertaking whose engineer and manager is a member of the Institution, on payment to the Hon. Treasurer of the Institution of the sum of 10s. 6d. in the case of undertakings whose make is below 50 million cubic feet per annum, and £1 1s. in the case of undertakings whose make is above 50 million cubic feet per annum, upon registration, and subsequently upon Oct. 1 every year. In addition to representatives so elected, the section may, on the recommendation of the Committee of the section, co-opt persons who, by reason of their professional knowledge and experience, are qualified to assist in advancing the objects of the section. Such persons must be members of the Institution. Provided, further, that such co-opted members shall not exceed three in number.

3.—The accounts of the Special Purposes Section shall be kept separate from those of the Institution; and a balance-sheet to Sept. 30, duly audited, shall be submitted to the Committee every year.

4.—Sub-sections will be formed in various centres, each having a local Secretary, who shall collect and prepare information and forward summarized reports to the other sub-sections and to the Committee of the Institution, and shall also submit to the latter an annual report of the proceedings.

5.—The control of the whole organization, of its sub-sections, officers, finances, and operations, shall be vested in the Executive Committee of the Institution, who shall be competent to discontinue

and wind up the section, whether as a whole or part, upon Sept. 30 in any year, after notice given at the preceding autumn general meeting of members, if its continued existence shall be found incompatible with the best interests of the Institution. Each sub-section shall appoint its own officers, whose appointments shall be subject to the approval of the General Committee. Notice of any proposition for amending these rules must be given at a general meeting of the Institution, and such notice shall appear on the *agenda* issued to the members for the following general meeting.

Mr. J. Robb (Chepstow) asked what duties would be likely to be performed by the section—what the aims and objects would be.

The Hon. Secretary said they were following in the footsteps of the other District Associations—such as the Manchester, the Southern, the Eastern Counties, and the North of England. The object really was to keep in touch with regard to prices of coke, tar, and other things—general commercial transactions—and to, as it were, guide one another as much as possible for mutual benefit, and to take combined action in certain cases where necessary. They could take up (say) the question of railway rates and things of that kind.

Mr. George T. Andrews (Swansea): Joining this Commercial Section does not bind you to fixed prices for coke, tar, &c.?

The Hon. Secretary: It binds us to nothing.

Mr. G. Mayne (Penrhiwceiber) remarked that in the matter of prices there were, of course, difficulties in connection with some works which were not present in others.

The President thought these matters were subjects for consideration at future meetings of the section. He moved the adoption of the rules.

Mr. Brookman seconded; and the proposition was agreed to.

The Proposed Evening Classes.

The President remarked that the next matter was the evening classes for training fitters and members of the outdoor staff of gas undertakings. Those members who were present at the Cardiff meeting in May last, would remember how ably this question was brought to the notice of the Institution by Mr. Madden, who read an excellent paper on the subject. The matter being thus started, the Council had met on several occasions since, and had endeavoured to formulate some sort of scheme as a beginning. It was a very difficult matter, and one in which local considerations had to be taken into account. They had also to cover a very large and scattered district. Therefore it might take a little time and patience before the scheme was in working order. He would ask the Hon. Secretary to report generally what had been done up to the present.

The Hon. Secretary said they were well forward with the arrangements so far as Cardiff was concerned. The main difficulty had been to get what they considered a capable teacher. It would be no use to do the thing by halves. For Cardiff they had now a teacher in view. Arrangements for classes at Pontypridd and Newport were getting on; and there was every hope of having a class at Swansea. This was as far as they had gone. They intended to circularize the members as soon as the arrangements were completed.

The Thermal and Thermo Dynamic Efficiency of Town Gas in Practice.

Mr. Thomas Canning (Newport) then read a paper on the "Thermal and Thermo Dynamic Efficiency of Town Gas in Practice." This, together with a report of the discussion to which it gave rise, will be found on pp. 42 to 46.

Mr. Brookman proposed a vote of thanks to the author, and remarked that it had been decided to further discuss the paper at the next meeting. Its importance required fuller consideration for it than they were able to give that day.

Mr. Andrews seconded; remarking that the paper required careful study.

The vote was heartily accorded; and Mr. Canning briefly acknowledged it.

Appointment of a Representative on the Council of the Institution of Gas Engineers.

The President said the next business was the election of a representative on the Council of the Institution of Gas Engineers for the year commencing in June, 1911. As members were probably well aware, the position was at present ably filled by Mr. Browning; but it would be necessary after June next to have a new representative. The Council had unanimously decided that the most fitting person to take up the duties of the position would be the retiring President, Mr. Brookman; but he would be pleased to receive any other nomination that might be made.

Mr. E. H. Swain (Pontypridd) proposed Mr. Brookman for the office. He had carried out the duties of President in such an excellent manner that he had proved himself fitted to represent the Institution in London.

Mr. Andrews seconded the motion; and it was carried.

Place of Next Meeting.

The President said that, with regard to the place for holding the next meeting, the Council thought it advisable on this occasion to leave the selection absolutely open. They would be pleased to receive suggestions from the members; but if no one had a proposal to make, the matter could be left in the hands of the Council for decision.

This course was agreed to, on the proposition of Mr. J. A. Boucher (Maesteg), seconded by Mr. Mayne.

Thanks to the Gas Company.

Mr. Madden proposed a hearty vote of thanks to the Chairman and Directors of the Newport Gas Company, for their kindness in placing a room at their disposal for the meeting.

Mr. Swain seconded, and the proposition was carried with applause.

Mr. T. H. Hazell, the Secretary of the Company, said he regretted the Chairman was not present to respond to the vote of thanks. In the estimation of the Directors, it was a very simple service that they had been able to render to the Institution that morning. It had been a pleasure to the Board to place the room at the disposal of the members. They felt that those connected with the industry were all members of a great co-operative society; and they wished the Institution well in their fight against darkness.

This concluded the business.

The Luncheon.

Business done with, pleasure became the order of the day, and, upon the invitation of the Chairman and Directors of the Gas Company, the members adjourned to the Savoy Hotel, where a party of about fifty sat down to luncheon. The Chairman, Dr. Melvill Brewer, presided; and he was supported by two other Directors of the Company—Mr. C. D. Phillips and Major J. C. Rennie Brewer. The guests having fully enjoyed the excellent fare provided,

Dr. Brewer, after the honouring of the Loyal Toast, asked Mr. Phillips to propose the next toast.

Mr. C. D. Phillips then gave "The Wales and Monmouthshire Institution of Gas Engineers and Managers." He dwelt upon the benefits accruing from meetings of this character—especially in the case of gas engineers, who were not opposed to one another in competition in the same district. Everything one engineer could teach another, he pointed out, was for the general good of the gas industry. They had one common enemy at the present time—the electric light; and they all did what they could to help one another to put this light out. He did not say they were going to altogether put it out; but gas people had the light that never failed, and so long as they possessed this, and did all they could to cheapen it and educate the people to the fact that it was the best light and also economical for heating, power, and other purposes, he was sure the industry had a great future in front of it. Mr. Thomas Canning, he believed, was the first President of the Institution; and now his son occupied this position. What could they want better than this—from father to son? He thought the paper presented to the members that day was one of the best commercial papers he had ever read. Mr. Thomas Canning was a scientific man; but they also wanted a man to bring in the money. The aim of the Institution was to be both scientific and profitable. They must make their science profitable; and he thought Mr. Canning had given them some very good ideas as to how this could be done. They all remembered the revered name of Mr. Thornton Andrews; and he was glad to see his son present with them, as well as Mr. Brookman, of Tenby, who was a very old friend of his. It was a pleasure to the Gas Company to welcome members of the Institution; and he hoped the day would be altogether a successful one. He coupled with the toast the name of Mr. J. H. Canning.

The President, in returning thanks, remarked that the Institution, considering that it was so young, had made great progress, and had been highly successful. This was due, in his opinion, to three causes. First of all, they had had a succession of able Presidents. In the next place, too much credit for the success of the Institution could not be given to their Hon. Secretary, Mr. Octavius Thomas, who had worked hard, and spared no pains at any time to promote the welfare of the organization. Last, but by no means least, a great deal of the success had been due to the support the Institution had received at all times from those directing gas undertakings—whether members of the boards of companies or of the committees of municipalities owning gas-works. They had extended hospitality and offered facilities for visiting works, and assisted in every way the holding of the meetings. One matter he would like to refer to was the question of papers. The Council, and he was sure also the Secretary, were desirous of seeing those who were in charge of smaller gas-works assisting as far as possible with papers at the meetings. Such papers would be welcomed; and no one need be afraid that undue criticism would be offered.

Mr. Brookman, in proposing "The Chairman and Directors of the Newport Gas Company," remarked that it was one of the most progressive concerns in the United Kingdom. In welcoming the Institution as they had done that day, they showed that they appreciated the efforts which were being made by organizations of this character to further the interests of the great gas industry. The Institution was practically a brotherhood, the members of which were always ready to impart to one another any information they might have. There was no stint in this respect, nor any attempt to hide anything. He coupled the name of the Chairman with the toast.

Dr. Brewer, in reply, said that when it was first known the Institution were coming to Newport, there was no hesitation on the part of the Directors in asking the members to accept the little hospitality they could offer them. They also wanted to show them their works at Crindau. He thanked them on behalf of the Company.

Mr. Thomas proposed a hearty vote of thanks to the Secretary of the Company, Mr. T. H. Hazell, for the trouble he had taken to make the occasion such a success.

Mr. Brookman seconded the proposal, Mr. Andrews supported it, and it was cordially agreed to.

Mr. Hazell remarked that he did not think there was any need for a special resolution of this kind. He had only carried out his duty in doing the best he could under the instructions of the Gas Company. From first to last, the desire had been to give the Institution a hearty welcome.

Mr. Brookman said there was just one other toast he would like to

propose—"The health of the esteemed Hon. Secretary, Mr. Octavius Thomas." No one who had not been President of the Institution really knew what was the value of Mr. Thomas's services. He was deserving of their heartiest thanks. On this subject he (the speaker) had once before made a suggestion; but it had not so far taken practical shape. This was, that they should make some sort of presentation to Mr. Thomas, who gave time and money to the Institution. In proposing the toast on this occasion, he would ask the members to carry out his idea. He would leave the matter in their hands; but he certainly thought the time had arrived when they should recognize Mr. Thomas's services by not only thanking him in words but also in substance.

Mr. THOMAS having briefly returned thanks,

Mr. ANDREWS said he would be glad, with Mr. Brookman and others, to form a Committee to carry out this project. He thought they had better proceed by first of all circularizing the members.

VISIT TO THE CRINDAU GAS-WORKS.

In brakes which had been provided, the members were then driven to the Newport Gas Company's Crindau Works. Though gas is still being made at the Mill Street station in the centre of the town, the principal manufacturing operations are carried on at Crindau, and no doubt in course of time the whole of the gas required will be sent out from these works. It was more than a quarter of a century ago that the increased demand for gas owing to the development of Newport led the Directors to acquire the extensive site at Crindau on which works designed by Mr. Thomas Canning were opened in 1885. Ample room exists for any further extensions of these works that may from time to time be required. When the party arrived, the services of a photographer were requisitioned; and then a tour of inspection was made, under the guidance of Mr. Thomas Canning, the Engineer and Manager, and of his son Mr. J. H. Canning. The time at disposal was profitably employed; and the only regret was that the visit could not be a longer one. In the design of the works, economy, uniformity, and the need for extensions in time to come are points that were perpetually kept in view. The works are in two ranges of substantial buildings situated on either side of a wide road leading to the coke-yards at the lower end.

The retort-house contains twelve benches of nine 18 feet retorts; each bench being equal to a make of 150,000 cubic feet per day, thus giving the entire house a capacity of some 1,750,000 feet daily. When it was determined to instal modern carbonizing plant, the walls and roof of the house had to be raised; and it was decided to do this without interfering with the original foundations. Hence, as regards length the dimension of the old retorts was adhered to. The members had the opportunity of seeing at work the Fiddes-Aldridge stoking machine, by which the discharging and charging are accomplished in one operation; and it was carrying out its task with smoothness and rapidity. Six-hour charges are the practice; the amount of coal put into each retort being about 8 cwt. Thus the Fiddes-Aldridge machine at each operation deals with some 14 cwt. of material—8 cwt. of coal, and about 6 cwt. of coke.

The siding from the Great Western Railway which serves the works stands about 25 feet above the general level; and this enables the coal to be tipped direct from the trucks either into the breaker-hopper or any portion of the store. Nowadays one frequently sees coal-waggons tipped by pushing up one end from underneath with a ram; but at Crindau the end of the 10-ton truck is drawn up by means of a travelling electric crane. Electric capstans of the most modern type also enable the traffic on the siding to be handled rapidly and efficiently. The coal is fed from the breaker-hopper through a powerful crusher; and it is then elevated to the top of the retort-house, and distributed by means of an endless push-plate conveyor to hoppers which run the entire length of the house, and which are fitted with Aldridge-Gibson patent doors for supplying the stoking-machine beneath. The stage floor of the house is, it may be remarked, built in reinforced concrete; and the retorts are heated by Winstanley regenerative furnaces.

The treatment of the coke at the Crindau works is also of an interesting character. On being discharged from the retorts, the coke drops straight into waggons (holding about a ton) on the ground-level, where it is partially quenched by water-sprays. These waggons run on rails, and are fitted with trunnions; and when they reach the outside of the retort-house, they are picked up by an electric telpher apparatus, dipped into a tank of water for the final quenching of the coke, and then carried to the store in the yard. Arrived here, the coke is gently deposited on the heap; the result being a remarkably small amount of breakage. This, however, is not the only work of the telpher, the track of which is continued over the railway siding at a high-level, and thus provides a rapid and very efficient means of loading coke (again with a minimum of breakage) into waggons. This is an important branch of the work, as, of course, much of the coke is sent away from the store in large quantities for shipment. In addition to what has been mentioned, too, the telpher is used for all traffic to and from the railway siding, except the tar, which is pumped up into tanks on the high-level, and the oil, which is discharged by gravitation into a tank on the works.

Attention was drawn by Mr. Canning to the fact that the water used for spraying the coke is not allowed to go to waste. After use, it flows into a culvert and passes through filters; and then, by means of a Gwynne high-pressure 3-inch centrifugal pump, it is raised to an overhead tank. From this, the water flows by gravitation to the sprinklers in the retort-house; and in this manner it is used over and over again.

Adjoining the retort-house are the condensers, scrubbers, and large tar and liquor tanks; while near these are at present being erected a tar-separator, with centrifugal washer-scrubber of the latest type. Just beyond the scrubbers are seen the boiler-house, exhauster-house, and pump-house. In the exhauster-house there is ample room for further sets of apparatus. Opposite the exhauster-house is situated a new power-house, where electric power is developed by means of gas-engines for distribution to the various points required in working. This building contains three gas-driven generating sets of a total capacity of 75 kilowatts. Thus there is derived from gas the whole of the energy required for the machinery which is particularly adapted for the distribution of this energy by means of electric motors; and experience has shown that in no other manner can electric current be so economically generated as by powerful and well-equipped gas-engines.

There are two purifying-houses, containing purifiers in groups of six. Those in the second house are of the most modern type; being fitted with Ramsden-Smith patent valves, and covers of the Green type. Both lime and oxide are used for purification; the former being necessary on account of the employment of Monmouthshire coal. Near the works entrance are situated the meter and governor house and the weigh-office, with other offices and testing-rooms; and behind the meter and governor house are the holders. There is a water-gas plant of the Economical Gas Apparatus Construction Company's type; and for this a separate set of apparatus is provided right up to the holder, where the mixture with the coal gas takes place.

All through the works, the visitors were struck with the cleanliness, orderliness, and extreme quiet prevailing. The workmen, it is hardly necessary to say, are well looked after. There are excellent recreation, mess, and bath rooms, &c.; and a portion of the land not yet required for extensions has been let out in allotments to the employees.

On leaving the works, the party returned in the conveyances to the Savoy Hotel, where tea was partaken of in the roof garden; and thereafter the members separated.

THE THERMAL AND THERMO DYNAMIC EFFICIENCY OF TOWN GAS IN PRACTICE.

By THOMAS CANNING, of Newport.

[A Paper read before the Wales and Monmouthshire District Institution of Gas Engineers and Managers.]

The intention of this paper is a very simple one. It is, within a brief compass, to draw attention to the value of gas as a fuel—applied in the first place to an internal combustion motor, and, secondly, as used in the ordinary gas-fire. Whole treatises have been written on at least one of these subjects; but the information regarding both is very scattered, is often confused, and is frequently uncertain. This paper is an attempt to collect and co-ordinate some at least of the information rather than to give the results of any original research. Some original points may be found here and there; but, as a rule, I have subordinated my own views to those of others whose opportunities have more especially qualified them for the valuable work of research. It would be impossible within the limits of a paper to give any adequate survey of so wide a field; hence I have only attempted to bring together some few facts, and to give a very few commonplace hints on certain practical points more intimately touching our own special business.

There is set out in the table below the thermal value of fuel—solid, liquid, and gaseous:

Heat developed per pound of steam coal . . .	13,800	B.Th.U.
,, ,, ,, ,, town gas . . .	18,960	,,
,, ,, ,, ,, petroleum . . .	18,500	,,
,, ,, ,, ,, producer gas . .	1,812	,,
,, ,, ,, ,, blast-furnace gas .	1,062	,,

The value given for coal is an average made up from the results of various tests of steam coals—some of high value and some low. In like manner, the value given for town gas is also an average, and is given in the gross. I know that it will be contended by some that the figure is too high; by others, that it is too low. It may be one or the other, but not in any great degree; for, so far as I have been able to obtain information, I think I have struck a fair average. The estimate I have given of the value of crude petroleum is taken from the best results obtained under the best conditions of working in the United States of America. Here I have been unable to arrive at any average; for petroleum, unlike coal, varies little in its composition. On the whole, then, it would seem that the manufacturers of town gas in Great Britain and Ireland are in possession of a fuel which, while it is the equal of the best liquid fuel, possessing also the advantage of being immediately utilizable, which the liquid fuel is not; it is superior to coal, and is 10·4 times more valuable than producer gas, and 17·8 times more valuable than blast-furnace gas.

It cannot be doubted that town gas, on account of its greater thermal efficiency, would be the one selected in every gas-engine were it not for the fact that the engine does not require for its efficient working a high flame temperature gas. A low flame temperature gas, such as producer gas, has been found equally suitable in working the gas-engine, and can be produced cheaper

than town gas. With respect to blast-furnace gas, this, of course, is cheaper than either, representing as it does ultimate cheapness, inasmuch as it is a bye-product which, previous to its utilization for power purposes, went to waste. Undoubtedly, the steam-engine, using coal as a fuel, especially with the improvements that have been made both in economy and adaptability in recent years, has still its own place, and will maintain it But, nevertheless, the steam-engine has not made such rapid strides, either for land or marine purposes, as has the gas-engine.

Ten years ago, a gas-engine of from 1000 to 1200 B.H.P. would be quoted, and has been quoted in fact, as an example of great advance. There are now installed at the Eschweiler Collieries, Alsdorf, Germany, twin tandem gas-engines of 2400, 2600, and 2800 B.H.P.; while the total capacity of the station is from 14,500 to 15,000 B.H.P. The gas used is coke-oven gas; and the capacity is twice that of the former steam plant, which has been removed in order to make way for the gas installation. But this is surpassed by another and very recent installation by the Indiana Steel Company, of Gary, Indiana, who have erected a gas-driven blowing plant for their blast-furnaces. The plant consists of eight units; each unit being a gas-engine of the Westinghouse four-cylinder twin tandem double-acting type. By these engines the blowing plant is driven so as to supply 265,000 cubic feet of free air per minute. The cooling water for the cylinders is supplied from a 16-inch main. The oil for lubrication is supplied from overhead tanks containing 2500 gallons, which are, in turn, filled by two storage tanks, each of 25,000 gallons capacity.

Reference is not made to these large plants with any other view than to show the progress made in gas-engine construction and adaptability, and to draw public attention to these facts, which contradict the prevalent delusion now existing that, when big units of power have to be considered, sources of energy other than gas have to be utilized. In fact, it has been recently rumoured (upon no sufficient authority, however) that gas may in future be employed as the motive power for battleships. It is idle to credit this rumour, which started on the launching of the battleship *Orion* the other day. Details of this vessel were supplied liberally by the Press; but, as a matter of fact, it may be taken as certain that no adequate details whatever have been supplied to the public, and that even the actual dimensions of this mighty battleship are known only to the few immediately concerned in knowing them. Still, it is supposed that the ship has an aggregate horse power of 27,000, obtained by four sets of turbine engines from eighteen Babcock and Wilcox boilers, which can, if required, burn oil fuel as well as coal.

This is conjecture. But he would be a hardy prophet who would say that a plant of this magnitude, if it exists, could be easily replaced by an existing form of internal combustion motor. Still, this is not impossible; for already oil-engines have been used on cargo vessels up to 800 to 900 shaft horse power, and with gas-engines up to about the same power. The advantage in the case of the gas-engine equipment was to give greater space for cargo. The producers were placed immediately above the engines, and economically, too; bunkers being placed directly over them in a deck casing, and the labour of storing and trimming consequently abolished. Attempts at the present moment are being made in Germany—and, it is to be understood, with hope of success—to employ Diesel engines up to 9000 shaft horse power in the aggregate, in cargo vessels. The power will be applied direct to the propeller shaft, as in these days, when there is a choice of almost perfect machine gearing, there is no need whatever to employ any other motor to facilitate the transmission of power; while the process of reversing can also be achieved with nearly as much facility as with the steam-engine.

But our attention has to be specially concentrated upon a gas that we produce ourselves, and which is made to suit other purposes besides that of power. Proceeding, now, from the point at which I started—namely, the question of thermal efficiency—I should like to place before you some of the results published by the Committee of the Institution of Civil Engineers, who, in 1906, made very valuable researches (and many experiments) on the thermal efficiency of gas-engines. Three gas-engines—one of 5 I.H.P., one of 25 I.H.P., and one of 50 I.H.P., were carefully tested at half-load and at full-load; and the following table shows the results.

Size of Engine.	5 I.H.P.		25 I.H.P.		50 I.H.P.	
Load.	Half.	Full.	Half.	Full.	Half.	Full.
Indicated horse power	3·6	5·72	14·5	25·9	34·1	56·3
Brake horse power .	2·87	5·20	10·82	20·9	27·9	52·7
Mechanical efficiency	0·80	0·90	0·75	0·80	0·82	0·94
Net B.Th.U. per hour	32,260	49,630	117,200	187,700	267,500	450,600
Thermal I.H.P. efficiency per cent. .	28·0	29·0	31·5	35·0	32·5	31·8
Thermal B.H.P. efficiency per cent. .	22·4	26·1	23·6	28·0	26·7	29·9
Thermal efficiency standard . . .	0·496	0·496	0·496	0·496	0·49	0·49
Relative efficiency I.H.P. per cent. .	56·4	58·4	63·5	70·6	66·3	65·0
Relative efficiency B.H.P. per cent. .	45·2	52·6	47·6	56·4	54·5	61·0
Cubic feet per I.H.P.	15·78	15·33	13·77	12·78	13·67	13·94
Cubic feet per B.H.P.	19·80	16·87	18·45	15·84	16·70	14·90
Air-gas ratio . . .	8·49	9·15	8·42	9·17	7·97	8·27

It is interesting to compare these results with those given by that very eminent authority on all questions connected with the gas-engine—Mr. Dugald Clerk. I will quote from his paper on "Limits of Thermal Efficiency in Internal Combustion Motors," read before the Institution of Civil Engineers [see Minutes of Proceedings, No. 3696, Vol. CLXIX., Oct., 1907, p. 129] :—

Designation of Engine.	L.	R.	X.
Exhaust waste.	34·1	37·1	39·9
Jacket waste and radiation . . .	34·1	29·6	25·4
Indicated horse power	31·8	33·3	34·7
	100·0	100·0	100·0

The engine powers are not given in Mr. Clerk's table; but the motors are designated by letters as above—the letter "L" indicating a small gas-engine, "R" a larger one, and "X" a somewhat larger one still. In the 5 I.H.P. gas-engine that was tested by the Committee of the Institution of Civil Engineers, the thermal efficiency is 29 per cent. at full-load; and in the gas-engine "L" tested by Mr. Dugald Clerk, is 31·8 per cent. In the 25 I.H.P. engine tested by the Committee, the thermal efficiency is 35 per cent. at full-load, and 33·3 per cent. in Mr. Dugald Clerk's test of gas-engine "R." In the 50 I.H.P. gas-engine tested by the Committee at full-load, the thermal efficiency is 31·8 per cent.; whereas in engine "X" tested by Mr. Dugald Clerk it is 34·7 per cent. Of course, it must be understood that the powers represented by "L," "R," and "X" may not have been, and probably were not, of the same powers as those tested by the Committee of the Institution of Civil Engineers. But it is somewhat curious to notice that, whereas the thermal efficiency rises regularly in Mr. Dugald Clerk's test, there is a drop in the thermal efficiency of the 50 I.H.P. engine as compared with the 25 I.H.P. engines tested by the Committee.

We now arrive at the point to which I attach the greatest importance, and to which I wish to draw your attention—namely, that the whole question of the economy and efficiency of a gas-engine depends principally upon its thermal efficiency; and the higher the thermal efficiency, naturally the greater economy there is in the use of the gas-engine. Now the figures given above, as you will see, represent, for the gas consumed, a relatively high thermal efficiency. For many years it has been supposed, and no doubt it is true of old-fashioned or badly-constructed gas-engines, that the efficiency was 20 to 25 per cent.; and upon this calculation many damaging statements prejudicial to the gas-engine have been circulated, and are still being made by ignorant people. They can be circulated no longer, however, for with small engines, worked by town gas, there is an efficiency of 30 per cent.; and as the engine goes up, the efficiency goes up to, let us put it roughly, 35 per cent. I will here briefly make one comment. Looking at this efficiency, it might strike a good many people that, considering the great loss in heat in the jacket cooling and in the exhaust, some one might do for the gas-engine what has been done for the steam-engine when the principle of double and triple expansion was discovered and applied.

I believe one maker of gas-engines tried some years ago to introduce two pistons; but his trial was in every sense a failure. The efficiency of the motor was lowered, and the mechanical difficulties created were so great that the engine was too complicated to be permanently worked. Nevertheless, it would be sometimes rather dismaying to know that there is apparently so great a waste, or what looks like waste, of thermo dynamic energy. Professor Bertram Hopkinson, after a long investigation carried out very carefully by himself and others, states [see Minutes of Proceedings, Institution of Civil Engineers, Vol. CXXVI., p. 212. "Hopkinson on Heat Flow and Temperature Distribution in the Gas-Engine"] : "Taking the engine on which the experiments here described have been made, it has been found that the quantity of heat carried away by the jacket-water in full-load running may be anything from 1400 to 2000 B.Th.U. per minute, according to the gas supply. Under average working conditions, it may be taken as 1600 B.Th.U. per minute."

This, however, is not so formidable as it looks; for it has been stated and proved by Mr. Dugald Clerk, as the result of his further investigations on "The Limits of Thermal Efficiency in Internal-Combustion Motors" [see Minutes of Proceedings, Institution Civil Engineers, p. 131, Vol. CLXIX.], that only 44·7 per cent. of the total heat given to the working fluid could be utilized, assuming heat lost to the walls to be entirely suppressed. Taking this as the basis of calculation, a gas-engine converting into power 30 per cent. of the thermal power available, has a thermal efficiency of 67 per cent. of the ideal value, and an engine converting into power 35 per cent. of the thermal units available has a thermal efficiency of 78 per cent. I have also seen recorded tests of engines converting into power 39 per cent. of the thermal units available; and in this case, the efficiency would be about 87·5 per cent. There is thus shown an enormous advance within the last few years in the power and adaptability of the gas-engine; and that, used with town gas, for many purposes, it is still the best, most efficient, and most economical motor, cannot be questioned.

Here is an instance in point. Recently at Newport a gas-engine has taken the place of an electric motor, which the consumer had found to be very costly. The gas-engine is only rated at half the power of the motor which it replaced; but it performs the same work at a cost even lower than the relative difference in

rated powers. The capital cost, however, of a gas-engine is considerable, and is the only reason, in my opinion, why it is sometimes passed over in favour of a less efficient motor. A remedy for this is only too palpably apparent. It is a well-considered scheme of hire-purchase; and unless this scheme is set on foot in every town where there is a demand for power supply, I am quite certain that progress of this form of utilizing gas as a fuel must, by the nature of things, be seriously hampered.

It is perfectly certain that the engineer or manager of a gas-works should take a very strong interest in the supply of a gas-engine, in its fixing, and in its working, within his own district. Frequently the gas-engine is bought by the consumer without any knowledge on the part of the gas manager; and it may be a very inefficient motor, on account of its type, or its age, or its condition. This is a great misfortune. Where possible, if this could be secured by hire-purchase, the gas-engine should be of the newest type by one of the best makers, properly fixed, and subsequently properly worked. In regard of the working of a gas-engine, I will only draw attention to two points, but two which are of supreme importance. The first is lubrication. Lubrication is infinitely more important in a gas-engine than in a steam-engine, and more especially the lubrication of the cylinder. There should always be used the proper oil and the proper quantity of it. The latter is frequently attained in the most modern type of engine automatically; but the user of the engine should be instructed upon the importance of having only the best oil and keeping up the full-feed.

Another point, and one of more importance still, is the size of the gas-meter. Makers of gas-engines are doing themselves great injustice by prescribing a meter too small. This, I regret to say, is almost universally done. In the case of a 120 H.P. engine, a 400-light meter is commonly specified by the makers of the engine, because the approximate quantity of gas required by the engine at full-load, per hour, is the quantity which this meter is calculated to pass within an hour. Now this is ridiculously wrong, and has a bad effect upon the meter, a bad effect upon the user, and the worst effect of all upon the maker of the gas-engine; for this want of capacity interferes seriously with the working of the engine. It is true that a 400-light meter working at full capacity will deliver 2400 cubic feet of gas per hour, working continuously throughout the hour; but how can the consequences be otherwise than bad if this same meter is compelled in a fraction of the hour to deliver in spasms and in jerks the quantity of gas required for the working of the engine? I need not dwell upon this further, excepting to draw attention to a formula by which I understand some people calculate the size of the meter required for gas-engines, and that is:

$$\text{B. H. P.} \times 3{\cdot}4 + 5 = \text{N.}$$

In the above formula, "N" equals the number of lights. It would be a pity to meddle with this formula; and for fear of spoiling it, I will not even hint at an improvement. But meters for gas-engine work should be supplied between two or three times the size now commonly specified. With reference to the injury done to the reputation of the makers of the gas-engine, I should like to draw attention to the fact that irregular and intermittent ignition follows the use of too small a meter, especially when the engine is running at full-load. Ignition fails to take place at the proper time, and what I might call post-ignition ensues. By the time, however, that ignition takes place, the exhaust-valve has been opened; and here I will leave this point, as those who understand gas-engines will be able to follow the rest of the consequences. Take "A," "B," "C," and "D," makers of gas-engines, the attention of "A" may be drawn by some gas engineer to this matter; but inasmuch as "B," "C," and "D" still prescribe the smaller meter, "A" is afraid to ask for a larger one for his engine. I trust, therefore, that makers of gas-engines as a body will consider this matter. It is no use for the gas manager to make a representation to the user and ask for a larger meter when the maker has prescribed a small one.

To complete this survey, I only add the following results recording the relative values of various fuels for generating power:—

Thermo dynamic value of 1 lb. of				town gas	= 1·80 B.H.P.
,,	,,	,,	,,	petroleum	= 1·66 ,,
,,	,,	,,	,,	best coal with modern engine	1·50 ,,
,,	,,	,,	,,	producer gas	0·176 ,,
,,	,,	,,	,,	blast-furnace gas . .	0·1035 ,,

Turning, now, to another way in which gas is used as a fuel, I should like to offer one or two observations on the value of a pound of gas consumed in a gas-fire. We have seen that in thermo-dynamic energy, town gas holds the foremost place. The answer to this question is not very far to seek; but perhaps the more authoritative answer is that given in the Appendix to the Gas Heating Research Committee's Report—a Committee which is still sitting, has done admirable work, and is likely to do better still. The report to which I here refer is the one presented to the meeting of the Institution of Gas Engineers in June last.

In Table I, No. 7, an open gas-fire, 13 in. by 6·5 in., with an eight-flame burner consuming almost exactly 1 lb. avoirdupois of gas in an hour, corrected to standard temperature and barometric pressure, gave 42·85 per cent. of radiated heat, and 37·15 per cent. of direct convected heat, while 20 per cent. of the heat passed up the flue. The temperature of the outside air was 14·3° C. (=57·7° Fahr.). This was raised to 28° C. (= 82·4° Fahr.), within the room; while the temperature of the flue air went up to 68° C. (= 154·4° Fahr.). I venture to say without doubt that this is a very good result. If a gas consumer can have the temperature of his room raised 25·7° Fahr., within a single hour of lighting his fire, and for the small consumption of 31 cubic feet of gas, there cannot be very much to complain of.

I will now take the case of a small fire tested under the same conditions and with the same glow-fuel—namely, fire-clay. I have used here a strange term—glow-fuel; and I should like to give one word in explanation of what I mean by this. The fuel in a gas-fire is gas; but it does not at the burner fulfil all that a fuel should do. Its work as a fuel is completed by the material subsequently applied to convey the heat. This material certainly fulfils some of the purposes of fuel; but as it does not fulfil all the purposes of fuel, I venture to call it glow-fuel. I will now refer to No. 6 on Table I., Appendix to the Gas-Heating Research Committee's Report. The dimensions of the fire were 4 in. by 9·5 in., the burner a three-flame one; the gas rate in cubic feet per hour 9·62; the percentage of radiated heat being 36·93 per cent. of direct convected heat 26·57 per cent. and 36·5 per cent. of the heat passed up the flue. The temperature of the outside air was 13° C. (= 55·4 Fahr.); while the temperature of the air inside the room was 27·5° C. (= 81·5° Fahr.), and the temperature of the flue air 64° C. (= 137·2° Fahr.).

Now it will be noticed that in the case of No. 7, the heat passing up the flue was only 20 per cent., while in No. 6 it was 36·5 per cent. Again, in the case of the larger fire—and, of course, it is to be understood in a larger room—the temperature was increased to 82·4° Fahr., whereas the temperature in the smaller room went up to 81·5° Fahr. This shows that heat and temperature are not convertible, and they stand in relation to each other very much as volume does to pressure. Here, in this small gas-fire, with a consumption of gas less than 10 cubic feet per hour, quite sufficient heat was generated to warrant the turning-down of the gas-fire at the end of the hour. With regard to actual thermal efficiency, the result is given in calories in the table; and these were, 136·7 in the larger fire, against 137·4 in the smaller one. I will not draw all the conclusions that might apparently, be drawn from these results. I am perfectly sure that the Committee do not themselves draw more conclusions from their experiments than are warranted up to now; and I will simply remark that the pressure to No. 7 fire was 3·21 inches, while the pressure to No. 6 was 1·12 inches. It will be noticed that with the high pressure and the wider fire the percentage of heat radiated, and the percentage recovered by direct convection, was very much higher than in the case of No. 6; and as these are the points to be arrived at—more especially the increase in the heat radiated—it would certainly go to show that a comparatively high pressure and a wide and not deep glow-fuel are the more desirable elementary conditions for a good gas-fire.

I say that I will not pursue this question, nor draw any conclusions under this head; I merely wish to point to the fact. What I prefer to say is this, that the results obtained with the small fire, with its very small gas consumption, are astonishing, and must convince anyone that there are no better or quicker means of heating a room, putting aside all question of cleanliness and convenience, than by the use of a gas-fire. To those who would care to follow up these questions of radiation and convection, I should like to refer them, in addition to the report of the Research Committee, to a paper read before the Institution of Gas Engineers at the Dublin meeting in 1907, by Mr. J. H. Brearley, of Longwood. In this connection, it is not so easy for me to show the relative value of 1 lb. of gas as it was in the case of the gas-engine; but I think we may be satisfied with what has been achieved by the makers of gas-fires up to the present, and that the absolute value of 1 lb. of gas, as set down in the table from which I have drawn my figures, shows that a very high thermal efficiency can be obtained. Can a higher thermal efficiency be obtained? Is all the heat that escapes through the flue lost? I have always ventured to think that it is not, and that the only heat that is lost is that which escapes at the top of the chimney into the open air. I do not say that the Committee in conjunction with the makers of gas-fires will not reach a higher thermal efficiency than has already been reached. I think and hope they will; but, as in the case of the gas-engine, I do think that we are approaching the realization of the ideal efficiency.

In the selection of gas-fires, it very frequently happens that the fire chosen by a consumer is not one that gives the best thermal effect. It is perfectly right that a maker of a gas-fire should try and render the appearance of it as artistic as he can, consistent with due observance of economy. Still, some of the best gas-fires at the present moment are not the most ornamental. It would be very invidious to point even to any type of gas-fire, for there are really on the market several good types. Generally speaking, however, the type which gives a fine area to the glow-fuel distributed thinly is the more efficient fire; and there is no reason why it should not have an ornamental setting. A very good type is that which combines with the quality that I have mentioned the quality also of the basket gas-fire, which is easily inserted in a fire-grate, and which gives when lighted a home-like appearance to the room. The fireside in winter is a sacred place to all of us; and the appearance of the fire in the historic glow of the log, or the clear burning coal, still carries all its traditional influence and glamour as the centre of home. The gas-fire must therefore be homely as well as efficient, and not too dear.

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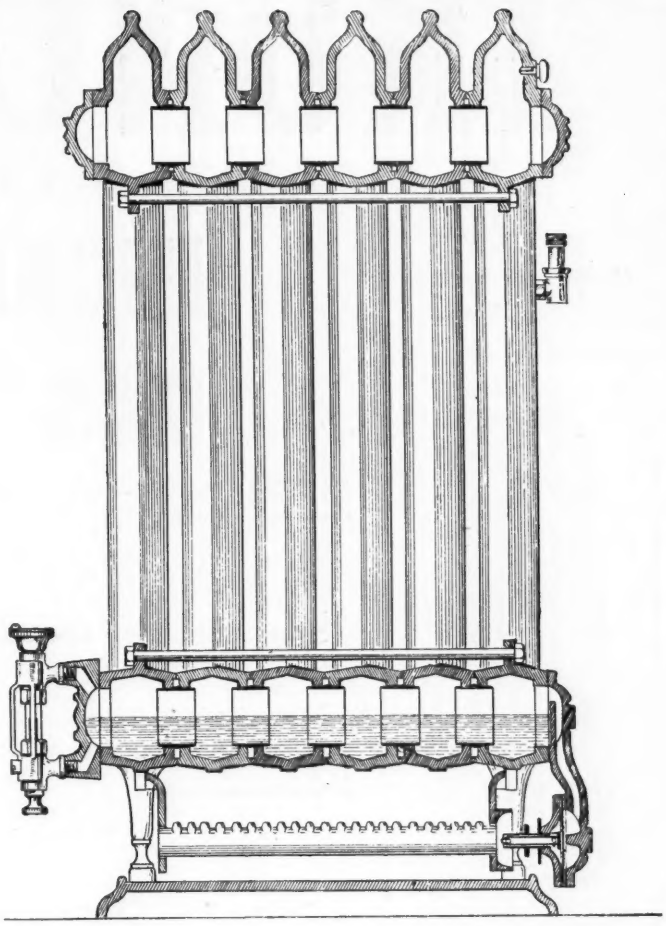

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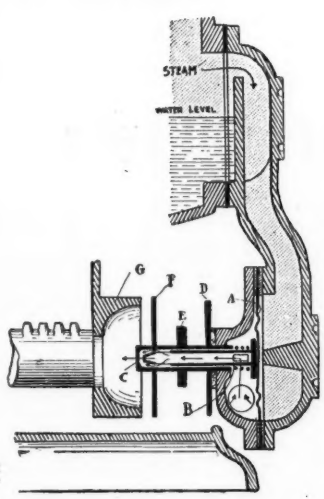

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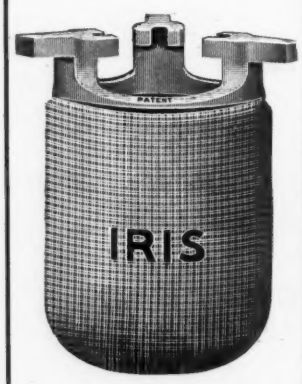

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flue as free as possible from angle hindrances, should be an ideal in this respect. Do not be afraid that too much heat will pass away; a great deal of it comes back in a useful form through the walls of the building. In addition to the flue, there is the gas and air adjustment to look to. No user of a gas-fire should be allowed to commence using it without being properly instructed by some member of the gas company's staff who understands thoroughly the proper adjustment of gas and air necessary for the efficient working of the fire, the proper glow-fuel, the proper quantity, and how to use it. The proper adjustment of gas and air and the proper flue area are two points to be well considered; and the care expended upon them will eventually result in a large increase in the use of this most convenient domestic appliance. If proper attention is given to the flue and also to the ventilation of the room, there will not be much need to speak of the danger of carbon dioxide or carbon monoxide. In respect of carbon monoxide, there is not the slightest chance of its appearance in any good gas-fire working normally.

Then, as regards carbon dioxide, whatever quantity of this is produced should find its way off in the flue gases; and only a down-draught, which must be provided against, would bring it back into the room. But, as a matter of fact, there is little to be feared from this carbon dioxide in connection with the burning of town gas. The carbon dioxide generated in the consumption of gas is very different from that exhaled from the lungs as far as regards health. The latter is already infected with organic impurities which may cause disease, whereas the former contains no organic impurity, and, up to a very considerable quantity, may be safely breathed even where little provision has been made for ventilation. But where ordinary ventilation obtains, the quantity present would be imperceptible. I should like to introduce a table from the lecture of Professor Vivian B. Lewes, on "The Use of Gas from a Hygienic Standpoint," printed in the Transactions of the Institution of Gas Engineers, 1907, p. 202:—

Gas Lighting.

Two Welsbach "C" Burners (on pendant) each Consuming 4 Cubic Feet of Gas per Hour, and Giving 140 Candles.

	Carbon Dioxide. Parts per 10,000.	Temperature. Deg. Fahr.
Outside air	0·03	61·0
Between joists	0 06	66·0
Ceiling level	0·44	74·7
Breathing level	0·05	63·0

Electric Lighting.

Three 16-Candle Power Incandescent Lamps.

	Carbon Dioxide. Parts per 10,000.	Temperature. Deg. Fahr.
Outside air	0·03	61·0
Between joists	0·04	61·5
Ceiling level	0·09	62·5
Breathing level	0·06	61·7

The increase in carbonic acid at the breathing level where electric light is employed, as compared with gas, is owing to the fact that the whole of the organic exhalations are left upon this level where electric light is employed, whereas in the case of gas they are carried up to the ceiling level. Now what is applicable to the incandescent burner applies with stronger force to the gas-fire; for this latter is aided by the flue. The truth is that with the great improvements that have taken place in gas-fires in recent years, tending to make them providers of radiant heat in the same sense as the ordinary open coal-fire, they are as healthy to use as, and very much more convenient and cleaner than, any coal-fire. They are also smokeless; and these certain advantages must assuredly advance from day to day the appreciation of the general public in regard to the value of the gas-fire.

On flueless gas-stoves, commonly called radiators or gas-heated steam-radiators, I should now like to make a remark. These stoves heat by convection; and, in my opinion, while not applicable for domestic heating, they may be applied with perfect safety and great advantage to the heating of public halls, churches, chapels, schools, skating rinks, &c. This question is simply one of ordinary ventilation, which should be carried out whether gas-heated steam-radiators be fixed in the building or not. I will just give one case in point here where these stoves have given the greatest possible satisfaction in Newport. The cubical content of the building in question is 29,532 feet. For the purposes of heating, there were fixed two twelve-double loop, 32 inches high, gas-heated steam-radiators, and two ten-double loop, 32 inches high. They have been fixed since Feb. 2, 1907, and have given up to now the greatest satisfaction. The building is ventilated upon the Boyle system; and on the date named, one twelve-loop and one of the ten-loop radiators were lighted—that is, half power—at 10 p.m. at night. At 10 a.m. on Feb. 3 the temperature inside the edifice was 48° Fahr., whereas the temperature of the outside air was 32° Fahr. The other two radiators were then lighted; and within one hour the temperature in the building rose to 60° Fahr.

The consumption during the night when the two radiators were on was 37 cubic feet per hour, and during the day, when the four radiators were on, the consumption per hour was 74 cubic feet; maintaining a temperature in radiator of 216° Fahr. The pressure varied, and was very probably all through higher than 1 inch, probably approximating to 2 inches. I think the publications by makers of gas-fires of gas consumption in any of their apparatus, tested under very favourable conditions with a low pressure, give results lower than can be obtained in real practice, causing dissatisfaction to consumers. From long experience, I should advise each maker, when giving the consumption of gas for anything he makes, to add 20 per cent. to his own calculation, and then he will approximate to the actual results obtained in every-day working all the year round. By some mistake on the first day, all four were allowed to remain lighted until six p.m. when the temperature had risen to 75° Fahr.—a temperature, of course, which is unnecessary and inconvenient. But it shows the power of a gas-heated steam-radiator. There has never been a complaint with respect to the action of these stoves from the day they were fixed up to the present time. They are attended to and inspected from time to time, and that is all. In this town alone there are no less than fifty churches, chapels, schools, and other public halls heated by means of these radiators, which in every case give the greatest satisfaction on the grounds of economy, efficiency, and health. I have not the smallest doubt whatever that this number will continue to increase very largely; but in this, as in all other matters, proper conditions of fixing, clear instructions to the user, and regular supervision, contributed very much to the success that has been achieved.

The experiences here recorded are respectable; but there are many others whose experience takes a far wider range than mine. Among them, as one who has had great opportunities of placing these stoves, I would cite Mr. F. W. Goodenough, of the Gaslight and Coke Company, who, I think, in this matter will not disagree very far with me.

In conclusion, then, I would say that manufacturers of town gas possess, as I have endeavoured to show, in the article they manufacture, a heating power of unrivalled efficiency, whether burning internally in a combustion-motor or externally in a gas-fire. For obtaining the highest results, it is only necessary to perfect the motor so far as in human things any approach may be made to ideal perfection. The rest will be simply a matter of convincing the public upon the point; and that conviction will certainly follow easily and readily the larger the opportunity that is given to the public of being able to test for themselves the intrinsic value of the gas-engine and the gas-fire.

Discussion.

The PRESIDENT (Mr. J. H. Canning, of Newport) trusted that he might be permitted to congratulate Mr. Thomas Canning on having given the members a very excellently thought-out paper, and one which was deep, and which covered an immense extent of ground. It was also a paper which would take a deal of hard thinking and mental digestion before it could be thoroughly appreciated. The author had dealt with one or two points to which he (the speaker) would like to refer. The first of them was on the subject of gas-engines. He would not say that it was impossible to buy a second-hand gas-engine that would give satisfactory results. This was far from the case. Given proper selection and proper judgment, it was perfectly possible to obtain a second-hand engine that would furnish good results; but there were a certain number of these engines at present being used by consumers which were exceedingly antiquated. He had known of engines that had been consuming anything from 40 to 60 cubic feet of gas per brake horse power; and such engines could not result in anything but great damage to the reputation of the local gas undertaking. It was a peculiar fact that consumers who employed machinery of this character saw the engine struggling day after day with indifference, and continually experienced the difficulties met with in starting it. Often it took half a day with some such engines before they were fairly started, and a large expenditure of energy on the part of the man driving it—and he might say, also a great deal of strong language occasionally. But in spite of all this, the consumer who had purchased the engine invariably refused to believe that there was anything wrong with it. First of all, he would make a complaint with regard to the pressure of the gas—at least, this was generally the order. Then he would complain that something was wrong with the service; and afterwards he would make complaint of the quality of the gas. Having finished the series of complaints, he would possibly start again at the beginning, and ring the changes on these three things *ad infinitum*. But in the long run—and this was the dangerous aspect—the electricity canvasser came on the scene, and the consumer was "ripe" and "fell into his mouth" without any effort on his part. The antiquated gas-engine, in fact, had been one of the most efficient canvassers the electricity undertaking could have desired. The remedy for this state of things was no doubt the one suggested by the author of the paper—that was, giving the consumers the opportunity of obtaining on the hire-purchase system the very best and latest type of gas-engine possible. Another question to which he would like to allude was the thermal efficiency of gas-engines. It was wonderful what a long time it took some of their electrical friends to come up-to-date with regard to what was taking place around them. He believed even at the present day some of them were inclined to base their calculations and comparisons of the relative efficiency of gas and electric lighting upon the old flat-flame burner. In fact, he had a distinct recollection of having seen some such comparison only a few weeks back. The maker of it apparently had never seen an incandescent burner. In the same way, it was frequently stated that the thermal efficiency per indicated horse power of a gas-engine was in the neighbourhood of anything from 19 to 22 per cent. Or perhaps some very generous people would put it at 25 per cent.; whereas they would see in the table given in the paper that the efficiency, even in the lowest

case, fell very little below 30 per cent. Therefore, the more publicity they could give to the actual results, the better it would be for them. The great point they must aim at was the obtaining of full credit for what gas was capable of accomplishing—whether for lighting, heating, or power purposes. The public were not generally aware of it. Those connected with the gas industry, of course, were; and they were—mistakenly—apt to think sometimes that the public were equally well informed. With reference to the question of gas-fires, there was one point that struck him greatly in the paper—and that was the difference of pressure under which the two fires alluded to were tested. One of them was tested, he believed, at about 3 inches and the other at 1 inch pressure; and from the manner in which the results were stated, it was impossible to make any comparison between the fires, unless a whole series of tests were carried out at varying pressures in the two cases. It seemed to him that a great deal of the superior efficiency of the larger fire was due to the higher pressure, inasmuch as such a pressure would tend to give a better mixture of gas and air in the burner, and possibly a better combustion. Then there was another point—and a very important one. This was the question of the flues to be fixed to gas-fires. Too much stress could not be laid upon this. At present flues were usually arranged in such a manner as to almost completely baffle the exit of the waste gases from the fire; the intention probably being to absorb as much as possible of the heat before entering the chimney. But the necessity for this arose from the fact that the "glow fuel"—if he might use the term employed in the paper—and the flame from the burner were not properly proportioned to each other. If such proper proportion existed, practically all the heat that should be withdrawn from the flame by the fuel would be taken up before the waste gases approached the flue of the fire; and the flue could then be arranged in such a direct manner as to carry off, without the least baffling or obstruction, the whole of the waste products. There was no doubt that a good many of the complaints one heard from time to time with regard to the inefficiency of gas-fires arose to some extent from this. Then with regard to the fixing of meters for gas-engines, and their size. It was quite clear that a gas-engine placed an extremely great strain on a meter as at present constructed. The question was whether the existing type of gas-meter was the best one possible for such a purpose. He felt some hesitation in dealing with this matter, because it was rather a thorny problem—a great number of factors having to be considered. There was no doubt whatever that the present gas-meter—either wet or dry—was a remarkably accurate and efficient apparatus, used under the ordinary steady, equal conditions of gas consuming. But when there was a draught through it, as the author of the paper had said, "in spasms and jerks," no meter of this type could possibly stand such treatment for very long. The point was therefore whether some better kind of meter for the purpose could not be invented. He knew perfectly well that the makers of gas-meters at present were bound down very tightly by the legal restrictions governing the sale of gas; but he would ask whether, in the public interest, it would not be advisable that this legislation should be revised, so as to afford a clear field and every opportunity for the invention of a new and more compact meter, on better mechanical principles than prevailed at the present time.

Mr. H. D. Madden (Cardiff) also thought the paper was one they could not deal with straight away. It seemed to him that they should study it, and carefully take all the points out, so as to see all that would emanate from the suggestions. They would find in it much food for thought. One great thing was that it had hammered home the case of gas and its purity, especially with regard to carbon dioxide. This was a bogey that they were faced with every day by their friends the electricians. One of the most important things they had to fight to prove, not to electricians, but the general body of consumers, was that air in which gas was burnt did not contain a greater proportion of so-called poisonous products than electrically lit rooms. Dissemination of this fact was very necessary. They could not leave off driving it home. They were moving in the direction of higher pressures and getting higher temperatures; and one often wondered why more was not done in this way. At Woolwich Arsenal they were doing all sorts of work with high-pressure gas; and they found that the higher the pressure, the greater was the heating value they obtained from it. In his opinion, the industry would move very much along this line in future. Another point which was important was the number of cubic feet of gas consumed in the engines shown in the table per indicated horse power and per brake horse power; and with reference to this, he would like to ask a question. When the engines were at half-load, there was a much greater difference between the figures of consumption per indicated and per brake horse power than when they were on full-load. Was he right in assuming that this difference was caused by overcoming the inertia and the friction, which were not in proportion so much when the engine was on its higher duty? They could not attach too much importance to the question of the composition and calorific power of their gas. He did not think so much attention had been paid to this matter as might have been the case; but it seemed to him most necessary that the gas should be sent out as constant as possible in regard to its calorific power, composition, and pressure over the whole of the district during every hour of the twenty-four. In the past year, he had been working on this subject. It was perhaps a little difficult to keep the pressure throughout a district constant over the whole day, and it was a matter that required a lot of attention in the first place. But they should, as far as possible, keep the pressure constant over the district through the twenty-four hours. This uniformity of pressure was a most important factor in giving satisfaction to the consumers who had fires and engines; and at the same time they should, as he had said, be very careful that the calorific power or constitution of the gas did not vary unnecessarily. There was every indication, he thought, that they would be able to work to very nearly a straight line on the district in both these matters.

The Hon. Secretary (Mr. Octavius Thomas, of Pentre) said he would like to refer to the question of the size of meter prescribed for an engine. The point that arose in his mind was whether it would not be better to have an anti-fluctuator of such a character as would overcome the difficulty of the size of the meter. Assuming that they had a meter sufficiently large to pass through in an hour the gas required for this period, could they not have an anti-fluctuator which would overcome the fluctuation of the engine?

Mr. R. A. Browning (Neath) remarked that he had heard that a large increase in the consumption of gas had been experienced in Birmingham, and it had been found that the use of producer gas was being largely done away with, and coal gas installed in its place. This was very satisfactory. Mr. Canning right through his paper had shown that town gas was much cheaper and better than producer gas.

Mr. Thomas Canning, in the course of his reply to the points raised by the different speakers [it was resolved that the paper should be further discussed at the next meeting], remarked that he had been very much struck with the warm praise given to the paper by the President; and he could only say that he did not suggest those words to him. [Laughter.] No doubt there must still be a great deal to be said on the question of pressure. The work under high pressure, so far as they had had experience of it, had certainly shown better results. To bring about what Mr. Madden had referred to—namely, a constant pressure, along with a constant value for the gas—would be ideal distribution indeed. If they could get up a practically constant day-load, and work to a straight line continuously, there was no question whatever that they need not fear the competition of anybody or anything. The President had alluded to the construction of the meter at the present time. Very many improvements had been made in respect to the gas-burner, gas-fire, and gas-engine; but to suit the varying demands which had arisen for gas, besides the ordinary consumption for domestic purposes, such as lighting and heating, they had not a special meter. He was inclined to think the time had arrived when they should have one; and he believed the suggestion of the President in this connection was a good one. Mr. Madden drew attention to a feature in one of the tables—that relating to the results published by the Committee of the Institution of Civil Engineers. It was a very striking point—the consumption of gas being so high at half-load and so comparatively low with a full-load. It would require considerable time to fully explain this; but Mr. Madden had practically furnished the explanation himself. It was the relationship existing between inertia and friction. Inertia, of course, would be considerably higher at the lower speed; and then it must be remembered that in the working of a gas-engine it was all a forward impulse. The consequence was that, as one increased the speed, one rapidly destroyed all the effects that might arise for impeding efficiency from either of the two elements referred to by Mr. Madden. The opinion had been expressed by Mr. Thomas that in all probability a good anti-fluctuator, properly fixed, would overcome the difficulty of having too small a meter; but he (the speaker) was not quite sure that it would. He was aware that there was a new anti-fluctuator being brought out which claimed to do this. As yet he had had no experience of it; but the anti-fluctuator itself would, of course (or ought to), automatically close the moment it had received the charge required for the engine. He knew that the idea had been tried of having two anti-fluctuators; and this had proved better, because one or the other came into use, so to speak, alternately. But, all the same, it amounted simply to this. An engine would only take in its charge of gas at the point of the cycle when it was required; and then it would take in its full charge, and would have nothing less. In the case of an engine running at a very rapid speed—say, 200 revolutions per minute—look what this meant. He thought the remedy was that the meter should be large. This seemed to him a better way out of the difficulty than to have an anti-fluctuator, though, at the same time, he had so open a mind on the matter that he should give the anti-fluctuator a trial. If it proved that it could overcome the difficulty, he would be very pleased indeed. Mr. Browning had touched upon an important point; and he was quite correct in what he said. In the small industries which thrived so greatly in Birmingham, but not at Newport, or Cardiff, or anywhere along that coast, there had been, and was to-day, an enormous gas consumption for the day-load which they could not get in their own district. These small industries required small gas-engines—he meant small compared with the leviathans he had referred to at the opening of his paper. Town gas had been used previously for these; but a little while ago suction producer gas began to take the place very largely of coal gas. There had not been a more cheering fact put before the meeting, or one that the members would be more pleased to hear, than the statement of Mr. Browning that in Birmingham they were going back to town gas again.

PROFESSOR HAROLD B. DIXON ON THE CHEMISTRY OF GASEOUS COMBUSTION.

Inauguration of the Manchester University Lectures.

THE first of a series of lectures on "The Science of Gas Manufacture and Combustion" arranged with the Manchester University authorities by the Manchester District Junior Gas Association, supported by the Manchester District Institution of Gas Engineers (to which reference has already been made in the "JOURNAL") was delivered in the Chemistry Theatre of the University on Saturday afternoon by Mr. HAROLD B. DIXON, M.A., Ph.D., F.R.S., President of the Chemical Society, and Professor of Chemistry at the University, who chose for his subject "The Chemistry of Gaseous Combustion." There was a large attendance, about eighty being present, including Mr. H. Kendrick (Stretford), the President of the Manchester District Institution of Gas Engineers, Mr. G. W. Shepherd, President of the Yorkshire Junior Gas Association, Mr. W. Cranfield, a Past-President of that organization, and Mr. F. Thorp, President, most of the members of the Council, and Mr. J. Alsop, the Secretary of the Manchester and District Junior Gas Association. These lectures, and an advanced course on "The Chemistry of Gaseous Fuel and Flame," have been arranged with the object of bringing gas engineers and others connected with the gas profession into closer touch with the University; the scheme having had its origin in a suggestion made by Mr. Thorp in the course of his Inaugural Address to the Junior Gas Association in January.

Mr. THORP presided, and in opening the proceedings said he would have preferred that someone more prominently identified with the gas industry had been appointed to the position; but the representatives of the Senior Association, with that magnanimity which had characterized them all along in connection with the framing of the scheme, had requested him to take the chair, because the idea originated with the Manchester and District Junior Gas Association, of which he was now President. By the members of the Junior Association, Oct. 1, 1910, would long be remembered as a day of days—a day on which long-cherished hopes and ambitions had been realized; and he hoped that Professor Dixon and the University authorities would have no reason to regret the kindness they had shown by arranging for the lectures now to be inaugurated. They were deeply indebted to Professor Dixon, who had given up another Saturday afternoon for their benefit—sacrificing himself on the altar of duty to give them the first lecture of the course. He (Mr. Thorp) would not weary them with a history of the movement, but he thought they all realized that the gas engineering profession ought to be raised in the eyes of the general public, and occupy a higher position than it now did in the professional world. Many people still appeared to consider a gas engineer as a sort of glorified foreman stoker; while an electrical engineer was always looked up to as something more than the general body of men. They hoped by the inauguration of these lectures to show that it was necessary for gas engineers to have the very highest technical and scientific attainments to enable them to keep their positions. He thought those who had recently inspected the new tank and gasholder in course of erection at the Bradford Road station of the Manchester Corporation would realize the skill and the technical knowledge required on the part of the Engineer under whose guidance the work was being carried out. It was hoped by the lectures which had been arranged to bring about a closer connection between the University and those engaged in the gas industry; and the general public would see, by the reports in the newspapers, that gas engineering demanded the highest skill and technical knowledge. He thought the day had passed when Universities were to be regarded merely as great centres for the learning of the dead languages. To-day they dealt with practical problems of everyday life. And they had all come to realize, in Mr. Balfour's words of the previous week, that "there never has yet been a great result attained for science which has not sooner or later had its re-action upon the fortunes of the whole human race." Now that they had a direct connecting-link between the Manchester University and the two local Gas Associations, he looked forward to something being achieved. It was quite true that they had at the Leeds University a Chair of Fuel. This, however, was more of a national affair; and it was hoped that much good would result from the scheme. At the Manchester University there would be, in connection with the new scheme, opportunities for research work which might have far-reaching results. They had on one side Professor Dixon (to whom they owed a great debt of gratitude), who was the first authority of the day on gaseous combustion and the chemistry of flame; and on the other they hoped to discover among their number an inventive genius who would be a worthy successor of the great engineering inventors of the past. Lancashire had from among her sons produced men of great inventive capacity in their own industry. In support of this statement he need only mention one name—that of Thomas Fletcher, of gas-stove and gas-appliances fame, who was born, he believed, within five miles of Manchester. He hoped that before this series of lectures had concluded they would be able to show the gas profession and the general public that the work of the two Gas Associations had produced something which was really valuable. Their opportunities were great. Should they grasp them, and show the world that they could not only obtain privileges but bestow favours by their exertions? He asked the members to give the scheme a fair trial, and support the Council by attending the lectures. The "Chemical Trade Journal," when noticing Professor Armstrong's paper at the British Association meeting, said: "If only one-fifth of the scientific knowledge that has been applied to the electrical industry had been applied in the gas industry, the latter would have been in a position to defy competition from any source, from the illuminating and heating point of view. But the help of science is not to be gained by pouring cold water on any scheme before it has had time to develop." He (Mr. Thorp) commended these remarks to their notice. If they did not succeed as well as they had hoped to do, he asked that cold water should not be thrown on the scheme, but that it should be given a fair trial. If this were done, and with the University staff to assist them, he was certain that something would be accomplished. In asking Professor Dixon to give his lecture, he (Mr. Thorp) said this gentleman needed no introduction from him to his present audience, as his work in the realm in gas science and practical experiment was too well known.

Professor DIXON, who was received with much applause, said that before proceeding with his lecture he had to apologize for the absence of the Vice-Chancellor. It had been his intention to be present; but he had been called away, and had asked him (the speaker) to express his regret at being unable to take part in what he called an "auspicious occasion." The privilege of addressing a body of experts, continued Professor Dixon, was always appreciated by a man of science, though he naturally felt a "fearful joy" in the fact that his audience brought understanding and knowledge to dissect his arguments and criticize his conclusions. "But," added the Professor, "my appreciation of the privilege I enjoy to-day rests upon a broader basis; for, however much this lecture may fall short of the ideal address, which is, I take it, to be intelligible to all and yet to contain something new to everyone, I have the satisfaction of knowing that you have asked me to speak on some aspects of the researches on combustion that have been of late carried out in the University under my direction, and that your presence is a sign that the members of your profession desire a closer connection with the scientific work of the University. I hold the opinion very strongly, and every year's experience confirms it, that the work of scientific laboratories is most fruitful when the directors of the laboratories are in touch with actual industrial problems. This is not to say that Professors of Chemistry should spend all their spare time in what you would call expert work. Far from it. But a professor is a better-armed man of science if he knows the methods and appliances of one or more of the great industrial processes; and, moreover, if it be his duty to prepare men to become works chemists, capable of original ideas, he will find that the road to success lies in his giving them research problems which have some bearing on their particular industry. It seems to me that, if our industries are to be scientifically guided, we greatly need more co-operation between the works and the university in dealing with the problems waiting for solution, even in the gas industry. Many problems can best be attacked on the small scale in the laboratory; and the man who, under proper guidance, has solved some problem and found the conditions of success can best guide and correct operations on a larger scale. It is for this reason that I welcome the beginning of what I hope will be a lasting connection between the Manchester University and the gas industry of the district. In Leeds, the leaders of the gas industry in Great Britain have established a Professorship of Fuel and Gas Engineering. I rejoice to think it has been founded at the Leeds University, and that the first holder is an old student of Owens College—Dr. W. A. Bone. I should like to congratulate the gas profession and the University of Leeds on the foundation of the George Livesey Professorship. In a more humble way, we desire to connect our department with the gas engineers of the district for our mutual advantage."

THE LECTURE.

Proceeding with his lecture, Professor DIXON explained that it was in 1876 that he first began his experiments on the combustion of gases. The problem was one which had to be investigated by Bunsen: How did one gas, such as oxygen, divide itself between two others, such as carbon monoxide and hydrogen, in an explosion, when the combustible gases were more than sufficient to unite with all the oxygen? Was the division of the oxygen in accordance with the law of mass action, or was this law modified in the peculiar "step-like" progression found by Bunsen? From this investigation three conclusions had been reached, one of which had been largely overlooked by chemists.

(1) The law of mass action was found to hold good; but the final equilibrium depended on two opposite reactions between the cooling gases being balanced; this equilibrium being reached after all the oxygen had combined. The opposite reactions were that between carbon monoxide and steam to form carbon dioxide and hydrogen, and that between carbon dioxide and hydrogen to reform carbon monoxide and steam:

$$\frac{CO + H_2O}{CO_2 + H_2} = \text{constant.}$$

(2) This constant was found to be greatly affected by the

temperature of the vessel containing the gases. A series of experiments clearly showed that the quantity of steam produced was larger the cooler the vessel. When the temperature was raised progressively, the proportion of steam formed fell regularly and then became constant. As this constancy always occurred at the point where steam could not be condensed on the walls, it was proved that the condensation of the steam took place during the actual duration of the explosion flame—

Temperature of Vessel. Deg. C.	Equilibrium Found. $CO + H_2O$ / $CO_2 + H_2$.	Temperature of Vessel. Deg. C.	Equilibrium Found. $CO + H_2O$ / $CO_2 + H_2$.
10	7·0	60	4·1
0	5·9	80	4·0
20	5·2	100	4·0
40	4·5	125	4·0

We conceive the gases to be composed of a vast number of molecules moving in straight lines and coming into collision one with another and with the sides of the vessel. In the flame an appreciable time elapses during which the molecules are in sufficiently rapid motion to react chemically with those they come into collision with. It must happen then that while the change is proceeding a number of steam molecules just formed in the flame strike the side of the vessel. The experiments show that a large number of these molecules stick to the surface (when it is cool), and, being condensed to the liquid form, take no further part in the chemical change. The removal of one of the reacting bodies, of course, alters the equilibrium, and less hydrogen and more carbon monoxide are found unburnt in the final products.

The mechanical action of a surface may thus largely modify a flame; but the physical nature of the surface may also profoundly affect the gases close to it, especially at a high temperature. We do not know the actual nature of chemical combination, but it is certainly related to the electric changes carried by the atoms. Heated lime and other earths give out a stream of negative "electrons;" and this discharge may facilitate chemical change in the layers of gas next to the surface. It would probably well repay the investigator who studied the electric action of the oxides used in incandescent lighting.

(3) The fact, discovered in 1876, that carbon monoxide and oxygen did not burn with flame when the gases were well dried, led to many investigations as to the action of moisture in chemical combustion. There could be no doubt, as Dr. Brereton Baker had shown, that water influenced the initiation of chemical change, and that such inflammable substances as phosphorus, sulphur, and carbon could not easily be ignited when dry, and that pure hydrogen itself showed peculiar resistance to ignition. But while steam, or liquid water particles, influenced the beginning of chemical changes, it did not follow that no chemical change could take place without the intervention of water, or that reactions at the high temperature of explosions did not occur directly between gases.

The extinction of a flame of carbon monoxide when brought into dry air [which was shown experimentally] might be due to the dissociation of carbon dioxide at the flame temperature. If the oxygen were taken from steam, the heat evolved in the change would be about one-seventh that due to direct oxidation. The CO_2 molecule would thus be comparatively cool at the moment of its formation; and though the total heat evolved by the indirect would be the same as that of the direct oxidation, the time required for the indirect change would be longer, and therefore the average temperature of the flame lower. At all events, carbon monoxide does react with steam, and the freed hydrogen can react with free oxygen; so that the hypothesis is a possible one. Many other hypotheses had been advanced to account for the disability preventing the oxygen burning the monoxide directly—one that the oxygen, *per se*, was too stable, or that gases only reacted in equal volumes. He had shown, however, that neither the stability of the oxygen nor the "law of equal molecules" could be the cause, for carbon monoxide would not explode with ozone, with chlorine monoxide, or with nitrous oxide. On the other hand, the dried gases united readily without inflaming in the presence of red-hot platinum, and in the burning of dried cyanogen the carbon monoxide first formed would burn in excess of oxygen—either prolonging the flame, as in explosions, or else burning with a separate flame, as in Smithells' flame-separator. Steam, therefore, was necessary for the burning of carbon monoxide only under certain conditions. The explanation suggested seemed the only one consistent with all the facts.

After describing the phenomena, and showing experimentally the immense rapidity and the violence of the explosion-wave in different gases, Professor Dixon briefly explained the theories that had been put forward to explain the propagation of the wave. In his sound-wave theory, as well as in the modified theory put forward by D. L. Chapman and M. Jouguet independently, each layer of gas is supposed to be fired in turn by adiabatic compression due to the burning of the layer immediately next to it; an intense pressure-wave being driven through the column of gases of sufficient intensity to fire the gas as the wave reaches it. *Such a wave—like a sound-wave—is propagated by collisions between two molecules.* As Sir J. Larmor had shown, there is no time for the occurrence of collisions between three or four molecules simultaneously. Such collisions are indeed comparatively rare, and practically all chemical reactions in gases must take place between two molecules—certainly all changes which travel with the rapidity of sound. But it has been shown that the explosion-flame does travel with this rapidity. If this argument is valid, it cannot be that in the explosion of gases all changes depend upon the interaction of three molecules simultaneously, one of them being water, as Professor Armstrong has contended. Any such changes as the burning of cyanogen to carbon monoxide and nitrogen when fired with its own volume of oxygen cannot require, as Professor Armstrong suggests, the triple collision of cyanogen, steam, and oxygen molecules to form products which would require another collision before giving the final simple bodies found. All the experimental evidence shows that no water is needed to bring about the change; and the rapidity of the flame is quite irreconcilable with the complicated changes suggested. Dr. Brereton Baker and Professor Bone, after experiments carefully conducted, agree with the view that water is not necessary for many reactions between gases at a high temperature.

With regard to the burning of hydrocarbons, Professor Bone has shown that the oxygen probably combines directly with carbon and hydrogen simultaneously—*e.g.*, that a marsh gas molecule and an oxygen molecule give in the first instance formaldehyde and steam:

$$CH_4 + O_2 = CH_2O + OH_2.$$

At the moment of collision, we may picture the marsh gas and the oxygen molecules forming an unstable oxygenated compound which flies apart into separate molecules the next instant. The lecturer said that so far he was willing to agree with the formation of Professor Armstrong's "compatible compounds;" but he could not agree that these have a separate "life" as molecules—*i.e.*, that they have the motion and the free path of an ordinary molecule. Such a "compound" is a mere phase in the collision, the redistribution of "affinities," and the "break-up" which occur in chemical change.

Professor Dixon next exhibited the apparatus he had used in studying the adiabatic compression of gases. He said he had succeeded in compressing various mixtures of gases, such as carbon disulphide with oxygen, hydrogen with oxygen, to the ignition-point, and photographing the flame produced on a rapidly moving film, so as to draw out and analyze the flame. These photographs, which were thrown on the screen, showed that the column of compressed gas was not ignited instantaneously, as Professor Nernst had predicted on theoretical grounds. In some mixtures, considerable time elapsed between the mixture reaching the "ignition-point" and the appearance of the flame. This "pre-flame period" was of considerable importance. During it the gases were self-heated through several hundred degrees centigrade at least. It had been shown, for instance, that a mixture of hydrogen and oxygen must have been self-heated to 1000° C. before the flame appeared, though the true "ignition-point" was lower than 550° C.

In conclusion, Professor Dixon drew attention to the conditions for obtaining the highest flame temperatures, and therefore, probably, the highest illuminating value, from gases. It was shown experimentally how pressure affected the intensity of combustion, and what must be sought for in using gas or air under pressure to secure greater intensity of combustion on the surface of an incandescent mantle.

At the close of the lecture,

Mr. D. V. Hollingworth (Salford) moved a vote of thanks to Professor Dixon for his address, and also for his great assistance and influence which had made possible the inauguration of these lectures and the formation of the classes for the study of the chemistry of gaseous fuel and flame. If the members of the Association desired to particularly thank Professor Dixon, they should do their best to attend the lectures and the classes; for he was sure no greater pleasure could be given to the Professor than to see the lectures and classes well attended, and to find students making use of the laboratories for research work. There was no reason why they should not build up a closer connection with the University, and so benefit the whole gas industry; and when they came forward with a greater scheme of research work, he hoped the Association would have the sympathy and the support of the whole of the Lancashire and Yorkshire gas industry. (Hear, hear.) There were several discoveries which were needed in the gas industry. Let them see to it that such problems had been solved by some member or members of the Manchester and District Junior Gas Association.

Mr. J. Alsop seconded the resolution, which was carried with acclamation.

Professor Dixon an Honorary Member.

At the request of the Chairman, Mr. Alsop read a resolution which had been passed by the Council of the Junior Association. It was to the effect that, to mark the members' appreciation of the valuable services of Professor Dixon in raising the status of the Manchester and District Junior Gas Association, and for the important educational assistance afforded to them by the inauguration of a series of lectures on the science of gas manufacture and combustion at the Manchester University, whereby a direct connection between the University and the Association has been established, Professor Dixon be enrolled an honorary member of the Association, and that a special membership card with the resolution inscribed thereon be presented to him.

Mr. Thorp then handed the membership card to Professor Dixon, remarking that the members might well call it "Dixon Day."

Professor Dixon, in responding, said he was much gratified at having this presentation. He felt they should one and all try to

take up this movement in earnest. He would like to see some of them undertake scientific research bearing on their own problems, with such help as the University could possibly supply, and with the encouragement which the University could give them. There was some stimulus to be derived from the very atmosphere of a place like the Owens College—a stimulus he had himself felt ever since the day he set foot in the laboratories where Roscoe and Schorlemmer had worked. The stimulus of research was—like the pre-flame period in gases—self-heating. A man who made a discovery as the result of his researches had more confidence in himself, and was more ready to tackle other problems; and if they did not exactly get what they aimed at, they would have the satisfaction of knowing they were always "somewhere near the unknown," and would be pioneers whose labours would be utilized by others. He begged to thank the Junior Gas Association for their kind resolution. The honorary membership of their body was an honour of which he felt justifiably proud; and the appreciative words with which it had been presented to him made it doubly welcome. He would always look back with pleasure to the day he became one of them.

This concluded the proceedings at the lecture. Subsequently, however, and after tea, a considerable number of the members of the Junior Association re-assembled in the Chemistry Theatre, when a discussion took place on the different points raised in the lecture. In this way some of the matters dealt with by Professor Dixon, not quite understood, were made clear.

GAS ENGINEERING AND FUEL DEPARTMENTS AT THE LEEDS UNIVERSITY.

Revised Courses of Study.

We have received from Dr. W. A. Bone, F.R.S., Livesey Professor of Applied Chemistry (Coal Gas and Fuel Industries) in the University of Leeds, the prospectus for the session 1910-11 of the Gas Engineering and Fuel and Metallurgy Departments. It furnishes particulars of special interest to some of our readers.

The courses of study have been drawn up to meet the requirements of students who are preparing for responsible positions either as gas engineers or in the fuel and metallurgical industries. The courses in Gas Engineering and in the Technology of Fuel will deal chiefly with the manufacture and distribution of coal gas and gas lighting problems, bye-product coking processes, and the production and application of gaseous fuels for heating and power purposes. Students who can devote three years to attendance at the University are strongly recommended to take the B.Sc. degree course; but they must previously have passed the matriculation examination conducted by the Joint Matriculation Board of the Universities of Manchester, Liverpool, Leeds, and Sheffield. During the first year, the student will attend classes in Mathematics, Physics, Chemistry, and Applied Mechanics. During the second year, he will continue the study of Physics and Chemistry, and also take a course in Engineering and Mechanical Drawing, as well as a special course of lectures on the Chemistry of Gases, supplemented by work in the fuel and metallurgical laboratories. In the third year, he will devote his attention mainly to his special subject, but will also spend six hours a week in the mechanical drawing office (Engineering Department). At the end of the course, the student will qualify for the B.Sc. degree by passing the prescribed final examination in his principal subject, *plus* Chemistry and Engineering as subsidiary subjects. A diploma in the Gas Engineering or Fuel and Metallurgy will be awarded to graduates of the Leeds or some approved University who, having graduated in science with Chemistry or Engineering as a principal subject, shall have attended for one year the prescribed course for the third year of the ordinary degree course, and have passed an examination thereon. The degree of B.Sc. with Honours may, in Gas Engineering or Fuel and Metallurgy, be conferred upon students who, having obtained a diploma, shall have spent an additional year in research in the Department, to the satisfaction of the Examiners. There are two-year courses, intended for students who, while not proposing to proceed to a degree, desire to take systematic instruction either in Gas Engineering or in Fuel and Metallurgy.

Students entering for these courses must produce certificates of having passed the Matriculation examination, the Oxford or Cambridge Local examination in Mathematics, the London University Matriculation or other approved examination, or they will be required to pass the University's special entrance examination, comprising Arithmetic, Algebra, Geometry, and Trigonometry. The first year's course will be the same for all students, and will include Mathematics, Physics, Chemistry, and General Engineering, up to the intermediate standard, with laboratory works in the three last-named subjects. The second year's course may be differentiated according to individual requirements, and will include Chemistry, Fuel and Metallurgy, or Gas Engineering, with practical work, and in certain cases Mechanical Drawing. Students who have passed satisfactorily through the two-years course may be permitted to enter for the diploma examination. In special cases, when a student has served an apprenticeship as a gas engineer, and has acquired a knowledge of Mathematics, Physics, and Chemistry substantially equivalent to the standard of the first year's diploma course, he may be allowed to take a one-year course in the subjects comprised in the second year's diploma course; but such one-year course will not entitle him to enter for the diploma examination.

The teaching staff at present consists of Dr. Bone, with Mr. Harold H. Gray, B.Sc., as Demonstrator, and the following Special Lecturers: Dr. Harold G. Colman, on "The Manufacture of Coal Gas;" Mr. Ernest Bury, M.Sc., on "Bye-Product Coking Processes." There are two other subjects in the prospectus—"Distribution and Uses of Coal Gas" and "Refractory Materials;" but the lecturers have not yet been appointed.

The following is the syllabus of the lecture courses:—

I.—Physical and Chemical Properties of Gases.

[Professor Bone, Thursdays at 2 p.m. throughout the session.]

(*a*) Kinetic theory. Fundamental gas laws. Van der Waal's equation. Compressibility and liquefaction of gases. The critical state. Specific heats. Dissociation. Diffusion and transpiration. Viscosity of gases. Modern theories as to the nature and conditions of chemical changes in gaseous systems. Velocity of reaction chemical equilibrium. Influence of moisture and surface in gas reactions. Occlusion of gases by metals and the action of gases upon solids generally. Principles of thermo-chemistry. Gas calorimetry. Heats of combustion of gases.

(*b*) The mechanism of combustion, &c. Slow combustion. Ignition-points of gaseous mixtures. Flames and explosions. The explosion wave. Rates of explosion. The combustion of carbon, carbon monoxide, and cyanogen. The combustion of hydrogen and of hydrocarbons. The action of steam upon incandescent carbon. The reversible system $CO + OH_2 = CO_2 + H_2$. The action of CO upon metallic oxides. The thermal decomposition of hydrocarbons.

II.—Technology of Fuel (General Course).*

[Professor Bone and Mr. Gray, Thursdays at 10.30 a.m., first and second terms.]

Fuels, their classification and distribution. Mechanical theory of heat. Heat transmission. Specific and latent heats. Variation in specific heats of gases with temperature. Heat recuperation. General chemical and thermal aspects of combustion. Fuel calorimetry. Pyrometry. Radiometry. Analysis of combustion products. Heat balances.

General description of fuels—natural gas, petrol, petroleum, shale oil, peat, coal. British coalfields and fuel resources. Analysis and valuation of coals for industrial purposes. Distillation and gasification of coal. Coalite. Coke. Coal gas, producer gas, and water gas.

Advantages of gaseous fuels. The firing of boilers and furnaces. Internal-combustion engines.

III.—Technology of Fuel (Special Course).

(Carbonization of Coal; Gaseous Fuels.)

[Professor Bone, Tuesdays at 11.30, first and second terms.]

First Term.—Distillation and carbonization of coal. Influence of temperature upon the character and yields of various products. General review of principles underlying carbonization processes and of operations involved in the manufacture of coalite, coal gas, and "bye-product" coke. Coal tar.

Second Term.—Principles underlying the gasification of coal and coke. Action of air and of steam upon incandescent carbon at different temperatures. The blast-furnace as a gas-producer. Cleaning and utilization of blast-furnace gas for power purposes. Gas-producer design and practice. Selection of fuels. Quantities of gas required for furnace work and for power purposes. Typical gas-producers, including suction producers. The cooling and washing of gas for power purposes. Ammonia-recovery system. Efficiencies of gas-producers. The manufacture and uses of "blue" water gas.

IV.—Manufacture of Coal Gas.

A special course of 20 lectures by Dr. Harold G. Colman on Wednesdays at 6 p.m. and Thursdays at 9 a.m. during the second term (January to March), to be delivered in alternate sessions—viz., 1911-12, 1913-14, &c.

V.—Distribution and Uses of Coal Gas.

A special course of 20 lectures on Wednesdays at 6 p.m. and Thursdays at 9 a.m. during the second term, to be delivered in alternate sessions—viz., 1910-11, 1912-13, &c., by specially appointed lecturers.

[Detailed arrangements for 1910-11 will be announced during November.]

VI.—Bye-Product Coking Processes.

A special course of eight lectures by Mr. Ernest Bury, M.Sc., on Saturdays, at 3 p.m., during the second term in alternate sessions—1910-11, 1912-13, &c.

VII.—Refractory Materials.

A special course of eight lectures on Saturdays at 3 p.m., during the second term in alternate sessions—1911-12, 1913-14—by specially appointed lecturers.

VIII.—Gas Lighting and Heating.

[Professor Bone, Tuesdays at 11.30 during the third term.]

The nature and structure of coal gas and hydrocarbon flames. Theories of luminosity. The bunsen burner. Construction of "atmospheric burners for various purposes. The incandescent mantle. Acetylene as an illuminant. Outlines of photometry and spectrometry.

The newly erected and equipped laboratories, particulars of which have appeared in the "Journal," will be open during the session from 9.30 a.m. to 1 p.m., and from 2 to 5 p.m., except on Saturday afternoons. A fully-equipped workshop, with mechanic in charge, will be provided in the new building. The equipment will allow for instruction and research in the following (among other) subjects: Gas analysis, photometry and spectrometry, gas

* This course is specially intended for engineering students and others who wish to acquire a general knowledge of fuel technology. It will also form part of the second year's course for students taking the B.Sc. degree in either Gas Engineering or Fuel and Metallurgy.

calorimetry, gaseous combustion and explosions, the chemistry of gas production, testing of gas coals, and experiments with gases under high pressures, including compression and liquefaction of gases, and the analysis and testing of coals. Arrangements will be made to enable regular students to carry out efficiency trials of gas-producer plants, &c., and help will be given to those who desire to gain practical experience in gas-works during the summer months. Students will also be encouraged to make themselves acquainted with the researches which are being carried out in the department, the results of which will, at convenient intervals, be explained. In this connection, the prospectus states that, in addition to the work which is being carried out by the holder of the Gas Fellowship established by the Institution of Gas Engineers, an investigation on the use of coal gas for heating purposes is being conducted by a specially appointed Research Chemist, under the direction of a Joint Committee appointed by the Institution of Gas Engineers and the University. Students will therefore be able to study the methods which have been devised for the investigation of gas-fires, &c.

Midland Junior Gas Engineering Association.

The programme of the forthcoming session of the Association, which has been received from the Hon. Secretary (Mr. G. C. Pearson, of the Nechells Gas-Works, Birmingham), shows that the following are the fixtures: Oct. 8, Presidential Address of Mr. R. S. Ramsden, of Burton-on-Trent, and a paper on "Tar Distillation," by Mr. A. R. Warnes, of Messrs. J. Hardman, Limited, Birmingham. Nov. 12, a paper on "Ammonia Recovery, with Special Reference to Apparatus employed therein," by Mr. W. H. Johns, of Birmingham. Dec. 10, visit to the Birmingham University. Jan. 14, 1911, a paper on the "Development of Incandescent Gas Lighting," by Mr. W. J. Pickering, of Birmingham. A date in January to be fixed later, evening visit to Messrs. Parkinson and W. & B. Cowan's Birmingham works. Feb. 11, a paper entitled "Practical Hints on Retort-Setting," by Mr. T. Brooke, of Birmingham. March 11, a paper on the "Birmingham Coal Test Plant," by Dr. W. B. Davidson and Mr. G. C. Pearson, of Birmingham. April 8, visit to a works. Some date in May, joint meeting of the Junior Associations in Birmingham. The Council invite the co-operation of each member in their endeavour to increase the membership of the Association, which, they point out, having regard to the important and extensive district covered, is not nearly so large as it should be. No doubt, those who have already experienced the benefits accruing from joining the Association will do their best to increase the membership-roll.

"Transactions" of the Belgian Gas Association for 1909-10.

We have received from the Secretary of the Belgian Association of Gas Managers (M. Emile van Heede, the Manager of the Molenbeek Koekelberg works of the Compagnie Continentale du Gaz, in the suburbs of Brussels) the "Transactions" for the year 1909-10. The general meeting was held on the 16th of June, 1909, in the Hôtel Ravenstein, under the presidency of M. Prisse, the Director of the Compagnie Générale pour l'Éclairage et le Chauffage par le Gaz. The technical matter submitted to the members, and contained in the pamphlet, consisted of a communication by M. Coune, on "The Bueb System of Vertical Retorts;" and it was followed by a report by the Gas Committee of the Ghent Town Council on the conditions for the future supply of gas, which concludes with the adoption of a calorific instead of an illuminating standard for the gas. It was brought up by M. Jean de Brouwer; and it was decided to include it in the "Transactions." M. Van der Willigen contributed a paper on "Carburetted Water Gas for Small Works;" and M. Greyson de Schodt discoursed on "The Utilization of Gas." The rest of the pamphlet is occupied with descriptions of the four gas-works supplying Brussels—the Municipal, Forest, Jette St. Pierre, and St. Gilles—accompanied by a number of plates. The first three of these works were described in the "JOURNAL" in connection with the visit of the Institution of Gas Engineers and of the members of the Société Technique du Gaz en France to Brussels last June; and some particulars of the other will be given in an early issue. The Association received from the Gas Department of the Municipality, from various local authorities and companies owning gas-works, and from trading firms, a sum of 27,600 frs. (£1104) for the erection, equipment, and carrying on of the pavilion in the grounds of the International Exhibition. The revenue for the year to June 15, 1910, was 46,747 frs. (£1870), and the expenditure, including 13,673 frs. (£547) for the pavilion, 15,460 frs. (£618); leaving a balance in hand of 31,287 frs. (£1252).

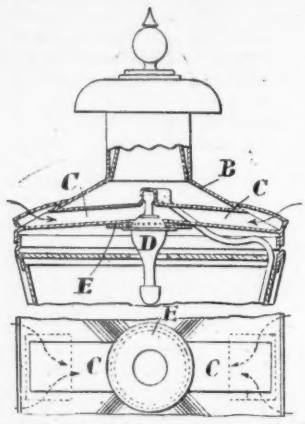
The Engineering Exhibition at Olympia was brought to a close on Monday evening last week with an informal gathering, at which Captain H. Riall Sankey, the Chairman of the Council, presided. Having briefly referred to the success of the exhibition, he called upon Mr. Doherty, of the Worthington Pump Company, to make a few remarks. Mr. Doherty complied with the request, and, on behalf of the exhibitors, asked the Organizing Manager (Mr. F. W. Bridges) to accept a gold card-case as a small memento of their appreciation of him. Earlier in the day, a meeting of exhibitors was held at which a resolution was passed expressing satisfaction at the way the arrangements had been carried out.

REGISTER OF PATENTS.

Lantern for Inverted Incandescent Gas-Burners.

EDE, E. P., of Highbury, N., and KEMPTON, C. H., of Vauxhall, S.E. No. 16,411; July 14, 1909.

In a street lantern constructed according to this invention, the air supply is led through passages extending from the walls of the head or top of the lantern to the burner; while the products of combustion are dispersed by a baffle below the air passages so as to deflect them towards the sides of the head of the lantern, and allow them to escape through the tent surmounting the lantern.



Ede and Kempton's Street Lantern for Inverted Gas-Burners.

A vertical section is given of the lantern, with its top closed down, and a part plan of the underside of the head. The lantern comprises the usual body portion and a hinged head and tent. Within the head B are provided two passages C, extending from oppositely disposed openings, in the head and meeting above the burner D. These passages may be slightly inclined upwards (as shown) or horizontal; and the openings are provided with shields, having side openings to prevent a too rapid inflow of air. Where the passages meet, there is formed an opening through which the head of the burner projects, and is attached to the gas-supply pipe; the air supply entering the burner at its top. The lower portion of the burner passes through a circular opening in the reflector which surmounts the lantern body. Below the air-passages C there is a baffle E, preferably in the form of a circular plate surrounding the top of the burner. When, however, the lantern is to carry two burners, the opening is elongated to allow them to pass through it.

The air supply enters the passages C from opposite directions, and on reaching the centre of the lantern enters the burner D, where it mixes with the gas in the usual manner. The products of combustion pass up through the opening in the reflector, strike against the baffle E (whereby they are deflected towards the sides of the lantern), and pass upwards to the tent, whence they escape.

Manufacture and Purification of Coke or Other Fuel.

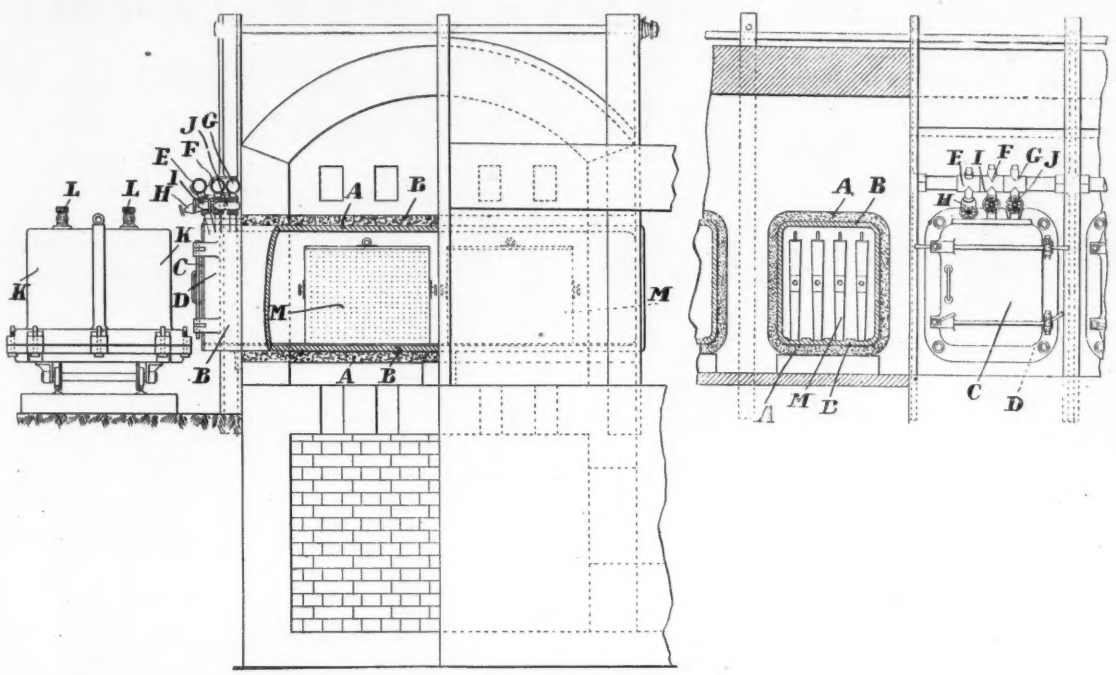
SIMPSON, W. S., of Battersea Park Road, S.W.

No. 20,237; Sept. 3, 1909.

This invention—relating to "apparatus for, and methods of treating, carbonaceous substances in vacuum for extracting impurities therefrom and for purifying the coke"—is shown in part sectional side elevation of the furnace employed, and a part sectional front elevation of a portion of the furnace; one retort being closed and the other open and showing the cases or packages for containing the fuel. The earlier invention was described in the "JOURNAL" for Aug. 30, p. 578.

The retort (or series of retorts) is made of a fire-resisting material A, lined with a cast-iron or steel tube B, which projects somewhat at one or both ends. The ends may be closed by cast-iron doors C, arranged so that they are easily closed or opened and form an air-tight joint when closed. The projecting ends D are provided with three tubes E F G, affording inlets or outlets to the retort. These pipes are fitted with cocks or other closing devices H I J; so that they may be opened and closed independently. In operation, one tube E is connected with an exhaust pump (not shown) whereby the vacuum is created and maintained in the retort, and whereby also the volatilized substances resulting from the distillation of the contents of the retort may be drawn off and conveyed into suitable condensing apparatus. A second tube F is connected with an external reservoir or generator of gases (not shown) suitable for the purpose of purifying the substances under treatment in the retort—such, for instance, as carbon monoxide, "which thus introduced is efficient to assist in eliminating sulphur and sulphurous compounds from the contents of the retort; and the third tube G is connected with a separate and auxiliary exhausting and condensing plant (also not shown).

In operating the apparatus, the valves I and J are first closed and the valve H opened to allow of a vacuum being created in the retort. To partially distil the coal or other substance forming the retort-charge and recover certain bye-products which volatilize at comparatively low temperatures, the vacuum connection E is then closed, and the desulphurizing and purifying gases are introduced into the retort, either by pumping or natural expansion. All the outlets from the retort being closed, the gas is admitted through the second pipe or tube F; and then, after a suitable time, this gas-supply tube F is closed, and the third tube or pipe G is opened. Further distillation of the sulphurous impurities and other bye-products is in this way carried on at varying



Simpson's Apparatus for Producing Coke.

temperatures, and the sulphurous impurities and further bye-products or impurities are separated and drawn off for condensation.

When the operation is complete, the doors of the retorts are opened, and the contents (still hot) are withdrawn and passed into a receiver K, so constructed that it may be hermetically closed and the air exhausted from it by a vacuum pump through the valved pipe L until its contents are cooled. Any further substances which may be given off while cooling are recovered, whether gaseous or otherwise.

In some cases, it is said to be convenient, before introducing the coal into the retort, to place it in suitable cases or packages M, both for convenience in handling and for shaping the coke into compact blocks or slabs during the cooling process. Such cases may be made of sheet iron or steel, preferably rectangular in shape, of any convenient length, and from 4 to 6 inches in width or thickness, having a cover hinged to one side and having suitable perforations on the edges or sides to allow the free escape of gases or other volatile substances during the process of distillation.

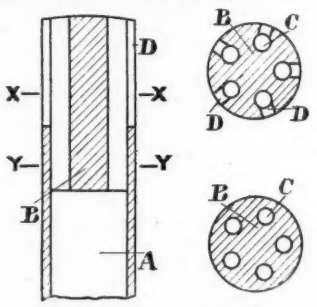
In cases where carbon monoxide is employed, this is generated without the use of steam, and may be generated in a separate receptacle and conveyed thence by a suitable pipe into the vacuum retort; or it may be generated in a receptacle having perforations in its top, which may be placed in the bottom of the vacuum retort or some other suitable part of the retort. In the latter cases, after the charge has been subjected to the first vacuum, the heat is raised to a temperature sufficient to generate carbon monoxide from the substances supplied within the retort. The carbon monoxide is allowed to remain for a period varying from 15 to 45 minutes, according to the magnitude of the charge, and is then withdrawn, and the process is carried forward to a completion.

Nozzles for Burning Gas.

MÜLLER, R., of Essen-Ruhr, Germany.

No. 25,261; Nov. 2, 1909. Date claimed under International Convention, Nov. 3, 1908.

In horizontal furnaces for coke making, &c., the gas for producing the needful high temperature is supplied to the burner-chamber by means of nozzles constructed on the bunsen principle—a construction that has "the disadvantage that the gas and the air are not properly mixed, but escape in separate jets from the nozzles." According to



Müller's Gas Burning Nozzles.

the present invention, the gas and air are thoroughly mixed, and the burning mixture properly distributed by means of an interchangeable burner-head comprising a number of cylindrical bores which, at the upper end, open into longitudinal slots along a certain length; so that the gases first become mixed, and the mixture then escapes in fan-like jets.

A longitudinal section through the burner-head is here shown with cross sections on the lines X and Y respectively. The burner-head A, connected in any desired manner to the mixing-pipe, is closed at the top by a solid part B, provided with cylindrical conduits C, which, at their upper portion D, are slotted along a certain length outwards. The number, size, and distribution of these channels C depend on the conditions of every individual case—on the nature of the gas to be burned, and on the size of the burner-head.

Retort-Furnaces.

TULLY, C. B., of Great Winchester Street, E.C.

No. 20,592; Sept. 8, 1909.

This invention relates to retort-furnaces of the type in which the gas-producer and combustion chamber are superposed and arranged between two groups of retorts, and communicate with one another by apertures arranged in, and along the length of, the dividing-wall; and the invention has for its object "to provide an improved retort-furnace of this type for the destructive distillation of coal in which the uniform application of heat to the whole length of the retorts and to each of the retorts in the setting is ensured in such manner that the burning of the retorts is precluded."

The gas-producer or furnace is arranged centrally within the setting and between lateral series of batteries of retorts, and it advantageously takes an elongated and relatively narrow form. The combustion chamber, which is divided off from the retorts, is constructed in the setting immediately above the gas-producer or furnace, and is of a length corresponding thereto; and a common discharging chamber is provided above the combustion chamber, into which the gases are led after passing from the combustion chamber, through the brickwork of the setting, and around the retorts and thence to the chimney.

The retorts are preferably provided of small diameter, and in sets which are arranged in series on each side of the furnace or gas-producer and combustion chamber, so that the radiant heat from the furnace and the combustion chamber is effectively utilized, while "the arrangement is of special convenience, in that access is obtained to the discharging door of each of the retorts from outside, and in that a space is left beneath the whole series of retorts on each side along which waggons may pass into which the residue of distillation may fall without the necessary use of any conveyor, and without the necessity of any discharging apparatus."

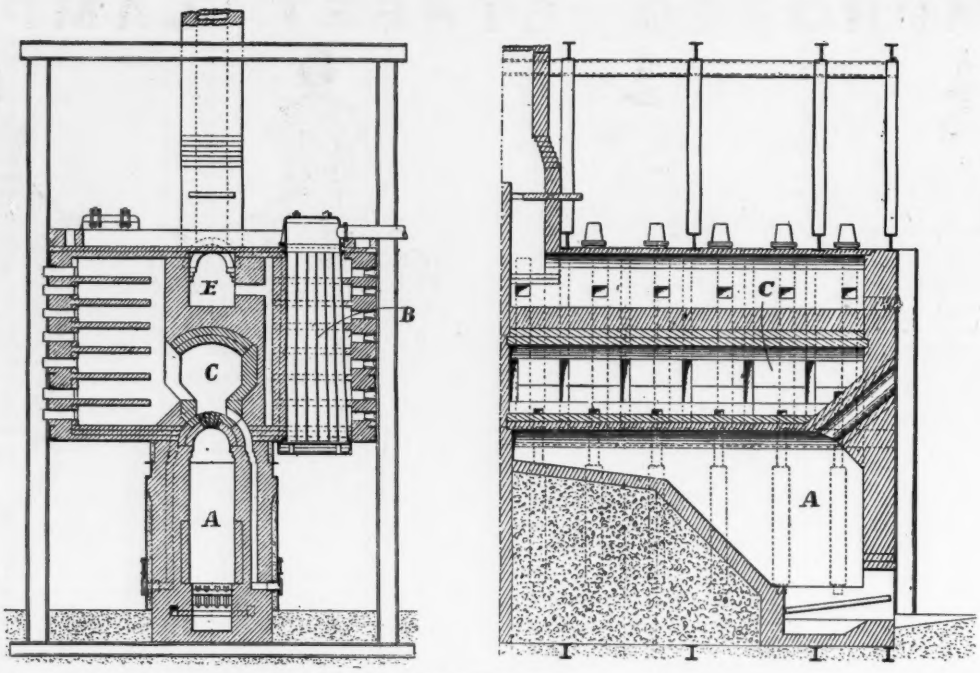
The illustrations on page 52 are a sectional end elevation of a retort-furnace setting—taken on separate lines.

The gas-producer A is built integrally with the retort-setting, and of fire-brick or refractory material, between two lateral series of retorts B. The gas-producer or furnace has an arch or dome throughout its length; and there are a number of holes or ports therein for the passage of the gases into the combustion chamber C, disposed immediately above, and in line with, the producer.

The charging tube (of fire-clay) is inclined towards the furnace chamber, and opposite to it in the furnace chamber is an inclined wall of fire-brick, which is advantageously extended rearwardly at a less inclination, so that the gas may pass out into the combustion chamber throughout the whole length of the furnace.

At each side of the furnace are passages, at intervals (for air) opening out near the lower extremities of the furnace setting and passing upwardly and around the arched top into opposite positions in the lower part of the combustion chamber, so that the air admitted to the latter is heated by traversing the whole length of the furnace on each side.

The combustion chamber has a number of lateral outlet apertures leading to a corresponding number of spaces disposed in a vertical plane or parallel with the respective sets of retorts. These spaces are formed



Tully's Retort-Furnace.

by vertical walls D, of which there are two on one side of each set of retorts and one upon the other side; the walls extending nearly the whole length of the respective sets of retorts and bending into the solid brickwork of the setting above and below.

A series of six horizontal partitions are provided in each of the spaces surrounding the retorts and between the walls D, so that the gases are divided into a corresponding number of streams.

At the end of the first vertical wall, dampers are provided by means of which the hot gases may be regulated as required; there being a damper for each of the separate passages formed by the horizontal partitions referred to. The gases then pass along the side of the second vertical wall in an opposite direction, and then in contact with one side of the set of retorts, passing then around and in an opposite direction along the other side of the set of retorts. They then discharge into a vertical passage common to the respective sets of retorts, passing thence to the gas discharging chamber E, which is disposed above, and in line with, the combustion chamber.

Recovering Ammonium Sulphate Direct from Coke-Oven or Retort Gas.

FABRY, R., of Sheffield.

No. 4473; Feb. 23, 1910.

The object of this invention is to recover simultaneously from coke-oven or retort gas the ammonia contained therein, together with so much sulphur as is capable of forming enough sulphuric acid to completely neutralize the recovered ammonia.

The principle of the process is based on the two following well-known reactions: 1. A neutral solution of sulphate of zinc brought in contact with gases containing ammonia and an excess of sulphuretted hydrogen is quickly decomposed, with simultaneous formation of dissolved sulphate of ammonia and a precipitate of zinc sulphide. 2. Zinc sulphide in solid but finely-divided form absorbs oxygen rapidly when roasted in an oxidizing atmosphere, and is converted into neutral zinc sulphate, provided the roasting takes place at a temperature sufficiently low to prevent the dissociation of the zinc sulphate produced. Both reactions are quantitatively complete, so that theoretically a given weight of zinc sulphate can be transformed into zinc sulphide and subsequently re-obtained without loss by oxidizing the latter at a suitable temperature.

The principle of the invention consists in washing the hot or cold crude coal gas by means of a neutral solution of zinc sulphate, and obtaining thereby, as final products of the gas-washing, a neutral solution of sulphate of ammonia and a precipitate of zinc sulphide, to the exclusion of any other dissolved or precipitated compound.

The pure and neutral solution of sulphate of ammonia finally obtained through the washing of the crude coal gas is concentrated by evaporation until the sulphate of ammonia crystallizes, and is recovered in the form of dry crystals. The zinc sulphide is separated from the ammonium sulphate solution before the latter's concentration and dried. It is then roasted at a suitable temperature in an oxidizing atmosphere, so as to obtain a fresh quantity of neutral zinc sulphate, which is dissolved and used again to wash the crude coal gas.

The process is preferably carried out with hot coke-oven or retort gases, so as to avoid any condensation of the water vapour contained therein, and so prevent the formation of any noxious effluent. It is also advisable that the hot or cold crude coal gases be thoroughly deprived of their tarry components before undergoing the process described, as otherwise the final products are liable to be adulterated with tarry matters.

The successful working of the described process necessitates the presence in the crude coal gas of a volume of sulphuretted hydrogen equal or superior to that which is necessary to combine with the ammonia contained in the same crude coal gas.

Should the gas under treatment not fulfil this condition, it would be necessary to increase artificially the volume of sulphuretted hydrogen available; and this may be most conveniently done, the patentee remarks, by adding the required quantity of sulphur in the coke-ovens or gas-retorts. Such added sulphur will be preferably run regularly in the retorts or coke-ovens in liquid or melted state. It will not affect the quality of the coke or gas produced, because it will be entirely converted into sulphuretted hydrogen when coming in contact with red-hot crude coal gas, and as such will remain volatile until it is subsequently recovered together with the ammonia.

The most important advantages of the process are said to be as follows: 1. No more sulphuric acid is required for recovering in a marketable form the ammonia from coke-oven or retort gas. 2. The whole process is carried out by means of neutral solutions and a neutral precipitate. 3. The whole plant is inexpensive to erect, inexpensive to work, and easily supervised. 4. All the ammonia and the bulk of the sulphuretted hydrogen are extracted from the coal gas. 5. The process may be carried out equally well both with hot or cold coal gas, and the results are unaffected by the temperature of the gas. 6. It may be easily and inexpensively applied to existing bye-product recovery plants. 7. The sulphate of ammonia produced is of excellent colour and quality—not containing any free acid or cyanogen compounds of any description. 8. The consumption of chemicals, steam, water, and power is very small.

APPLICATIONS FOR LETTERS PATENT.

21,727.—HARRIS, W. J., "Gas-ovens." Sept. 19.
21,728.—GERALD, E. E., "Gas-igniter." Sept. 19.
21,737.—STEWART, J. & W., and BETHELL, R. P., "Gas-producers and gas regenerative furnaces." Sept. 19.
21,789.—STETTINER CHAMOTTE-FABRIK AKT.-GES., "Retort-furnaces." Sept. 20.
21,865.—CAYLA, P. B. DU, "Gaseficator for hydrocarbon gas." Sept. 21.
21,869.—ADAMSON, R. A., "Cleaning pipes and tubes." Sept. 21.
21,870.—ADAMSON, R. A., "Joints for rods." Sept. 21.
21,894.—LANE, H., "Gas-producing apparatus." Sept. 21.
21,938.—BOZON-VERDURAZ, C. & J., "Making connections on charged mains without interrupting the supply." Sept. 21.
21,963.—HAWLEY, W., "Hurdle-grids of gas-purifiers." Sept. 22.
21,991.—COX, W., "Gas-meter diaphragms." Sept. 22.
22,052.—SCOTT, G. L., "Gas-stoves." Sept. 23.
22,126.—JAUBERT, G. F., "Extracting the free hydrogen contained in industrial gases." Sept. 23.
22,127.—TESSIER, A. C., "Manufacturing gas." Sept. 23.
22,159.—CLAXTON, E. J., and LEWIS, A., "Governing the flow of fluids." Sept. 24.
22,168.—SHAKESHAFT, C. E. M., and CLARKSON, T. J. R., "Coin-freed gas-meters." Sept. 24.
22,170.—SCOTTISH CENTRAL IRON COMPANY, LTD., and HARRISON, P., "Gas-fires." Sept. 24.
22,175-6.—PACE, P. C., "Generating combustible vapour." Sept. 24.
22,177.—WILSON, W. A., "Duplex burner for gas-stoves." Sept. 24.
22,181.—KEITH, J. & G., "Gas-lamps." Sept. 24.
22,183.—KENT, W. G., and HODGSON, J. L., "Measuring orifices placed in a pipe-line." Sept. 24.
22,184.—KENT, W. G., and HODGSON, J. L., "Automatically regulating the flow of liquids." Sept. 24.

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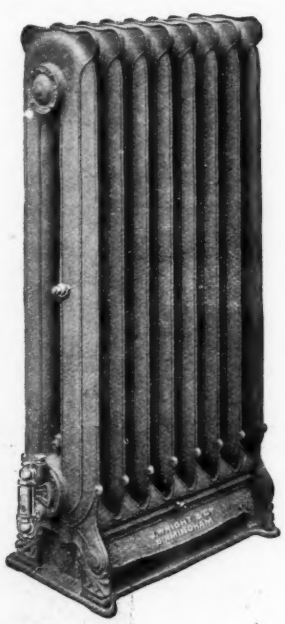

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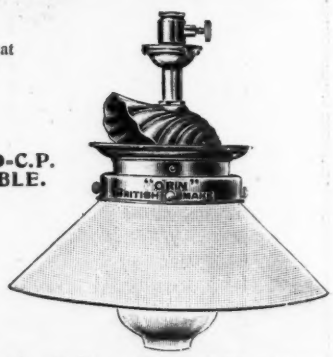

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The Relations of Municipal Gas and Electricity Departments.

SIR,—I have read with much interest the "Editorial" hereon in your issue of Sept. 20. Without expressing agreement or disagreement with the article in general, I will, with your permission, make a few comments on the paragraph relating to prices of gas and electricity.

So much has been said on electric supply economics, that it is difficult to add anything new thereto. I must, therefore, content myself with a restatement of the broad principles underlying any equitable system of charging for supplies.

Electricity undertakings, unfortunately, have next to no power of storage. They have to bear relatively high standing costs and low running costs; in other words, their chief expenses are due to the necessity of being in readiness to supply. The actual running costs, though proportional to output, are of much less importance. It must, therefore, be patent to all unbiassed minds that the total costs are bound to vary according as the hours of demand are long or short. Hence the value attached to constancy of demand, or, as it is usually termed, "load-factor."

Another feature bearing directly on costs is that, owing to the diversified character of consumers' demands for purposes other than lighting, and to the resultant differences in times of demand, it is not necessary to provide 100 per cent. of plant to meet the same amount of demand. Conditions in Manchester, for instance, are such that, at the utmost, not more than 40 per cent. of the sum total of consumers' individual maximum demands occurs at the time of heaviest load on the stations. The consequent saving in capital and other standing costs is obviously great. Hence the value set on the relation between consumers' peak-loads and station peak-loads, or, as it is generally termed, the "diversity factor."

From the foregoing, I think it will be readily seen that there is ample warrant for the wide disparity between the charges for electric lighting and for electric power supplies, or, to write more correctly, between short-hour and long-hour consumers.

A recognition of these principles, thus broadly stated, governing the prices of electrical supplies, has, I take it, enabled Mr. Newbigging and his colleagues of the Gas Department to come to the conclusion contained in the joint report.

Contrast the position of gas undertakings. Their power of storage, as is well known, is by no means slight. For example, with the completion of the new gasholder at Bradford Road, Manchester will have available more than a day's supply at any time of the year.

Their costs for material used in production—apart from equipment—are broadly speaking, proportionate to output. Their standing costs in relation to running costs are nothing like so important as with ordinary electric supply undertakings. Taken altogether, the economic bases of the two kinds of undertakings are strikingly dissimilar.

It is then quite evident that, under present conditions, the differentiation between gas-power prices and gas-lighting prices can never assume anything like the importance in the rival industry.

Finally, may I add that, should the day ever arrive when gas for power can be supplied in Manchester or elsewhere at 5·4d. per 1000 cubic feet, electricity departments will probably be prepared to buy in large quantities as their business extends? Considerable scope will offer itself for large gas-engines at electric generating stations when gas can be had at about the price named.

Dickinson St., Manchester, Sept. 26, 1910.

S. L. PEARCE, Chief Engineer, Manchester Corporation Electricity Works.

[Reference to our correspondent's letter is made in "Electric Supply Memoranda" on p. 22.—ED. J.G.L.]

The Salaries and Allowances Questions at Manchester.

When the Special Committee appointed by the Manchester City Council to consider the conditions of service of Corporation officials met again last Thursday, several members suggested that the Committee should dissolve without doing anything more, as a protest against the action of the City Council in passing at the last meeting increases of salaries recommended by the different Committees. It was contended that in sanctioning these advances the Council had nullified the whole of the work done by the Committee. Finally, on the advice of the Town Clerk, the dissatisfied members did not press their proposal to a vote. It was decided, however, not to proceed any further until after the November elections, when, according to present arrangements, the Committee will receive the views of the Standing Committees on the question of retiring allowances for officials. It will be remembered that at a recent meeting of the Council an elaborate report was presented by the Conditions of Service Special Committee, and that a resolution was carried referring the report back to the Committee, on the ground that it was not complete; the questions as to age-limit and retiring allowance not having been dealt with. Since then the Council have approved of increases of salary which, in some cases, exceed the maximum fixed by the Special Committee.

Price of Gas at Chorley.—The question of the price of gas to prepayment meter consumers was the subject of discussion at the Chorley Town Council meeting on Thursday, when Mr. Sandham, a Socialist member, complained that it was unjust to saddle the cost of fittings provided by the Corporation upon consumers by prepayment meter, who were charged 8d. per 1000 cubic feet more than users of ordinary meters. He contended that the difference should not be more than 1½d. or 2d. Mr. Wilson, in reply, said that, gauged upon the capital outlay, the cost to the Corporation for supplying gas through prepayment meters was 7·7d. per 1000 feet more than to ordinary users. A motion that the time was not opportune to reduce the charges to prepayment meter users was carried by an overwhelming majority.

MISCELLANEOUS NEWS.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly General Meeting of this Company was held last Friday—Alderman W. F. COTTON, D.L., J.P., in the chair.

The SECRETARY AND MANAGER (Mr. F. T. Cotton) having read the notice convening the meeting, the report of the Directors, with the accounts for the six months ended the 30th of June, were presented. The latter showed that the gross revenue amounted to £156,302, and the expenditure, including interest on loan capital, &c., to £115,838; leaving a profit of £40,464. Adding £438 carried over from the previous account, there was a total of £40,903 to the credit of the profit and loss account. The Directors recommended the declaration of a dividend on the consolidated ordinary stock at the rate of 5 per cent. per annum. Payment of this would absorb £36,534, and leave a balance of £4369 to be carried forward.

The CHAIRMAN, in moving the adoption of the report, said he thought the shareholders might congratulate themselves on the results of the working during the period covered, seeing that it was the first half-year's operations under the altered conditions caused by the Act of last year. They were aware that the Directors, in order to meet the views of the Municipal Council of Dublin and other local authorities, made a very considerable reduction in the price of gas, amounting to nearly £25,000 per annum on the amount sold. No doubt they were desirous of hearing how, under such circumstances, the Company had been so successful. Well, they might recollect that when he had the honour of addressing them in March he was in a position to say that one section of the new apparatus erected in the retort-house lately built at the Great Brunswick Street station had been completed and put in action, and that so far it had been giving great satisfaction, leading to considerable economy in the manufacture of gas. He ought to mention that, during the first three months of the half year under review, this section was not of sufficient capacity to manufacture gas to supply the city of Dublin and the surrounding townships; hence it was necessary to keep in action the old retort-settings as well as the new ones. However, to the use of this new section might largely be attributed the results which the shareholders had before them. The second section was on the point of completion. It would be brought into action immediately; and from its use they might well anticipate similar satisfactory results. He might remind them that in the corresponding period of last year it was found necessary to draw upon the reserve fund to the extent of £4034 in order to pay the dividends that were now recommended by the Directors; whereas on the present occasion, notwithstanding the enormous reduction in the price of gas, they were not only able to pay the dividends recommended on the half-year's working, but also to carry £4369 to the next account. With the new apparatus, the yield of gas per ton of coal carbonized was much larger than before; and this statement also applied to the coke, breeze, tar, and ammoniacal liquor. He expected that during the current half year they would make still greater progress; and he might say he saw no reason why this should not be so in the future operations of the Company, for he did not think they had nearly arrived at their best. Referring to the accounts, it would be seen that during the half year there had been expended, under the head of capital, £9993. Of this sum, £4750 was spent on engines and apparatus for the new retort-house, £2791 on new and additional service-pipes and mains, and £2451 on additional meters and automatic fittings. There was also an expenditure of £2694 on new burners and mantles; but this sum had been charged to revenue. Turning to the revenue account, it would be found that the sale of gas, including meter-rents, only produced £131,604, against £133,914 for the corresponding period of last year. However, for residuals they received £24,373, against £19,367; and besides they had savings in nearly all items of expenditure. Since the last meeting, there had been put in 1764 new automatic installations, each comprising a cooker, brackets, and pendants. There had also been let on hire and attached to ordinary consumers' fittings 614 cookers and 119 heating-stoves, in addition to 120 of these stoves, ten gas-fires, and seven cookers bought and fitted at consumers' expense. The Company had now in operation 38,000 free and 5575 hired cookers; also 612 heating-stoves and fires. This was a very small number for Dublin and the surrounding townships, even making allowance for their lesser population when compared with London and many other large towns and cities. It was calculated that there were in use in two of the London Gas Companies' districts 1,400,000 gas-cookers, water-heaters, and ring-burners for boiling purposes. While the Dublin works were in a state of transition to bring them under the new conditions imposed upon the Company, there were some complaints of bad light. But in nearly all cases it was found to be owing to the burners in use being quite unsuitable for the gas now supplied, which was 14-candle. This quality was precisely the same as that supplied all over London, Edinburgh, Glasgow, Manchester—indeed, all over the kingdom; for Parliament had for some years been reducing the standard to a uniform 14 candles with the new test-burner. There were at present in the House of Commons Bills which were only waiting third reading, whereby 43 companies would come under the new conditions. He regretted to say that there were still a considerable number of flat-flame burners in use by the Company's customers. When one considered that incandescent mantles had replaced the flat-flame burner in almost every city and town in the United Kingdom, it seemed strange that consumers of gas in Dublin should be so far behind in adopting a system so economical. One incandescent mantle would light a room 1600 cubic feet in capacity; and yet people would continue the use of the wasteful flat-flame burner, which consumed about four times the quantity of gas, and did not produce half the quantity of light. He might mention that in the case of consumers of gas by free slot-meters the Directors arranged when in Parliament to supply, and they were fixing for them on application, one incandescent burner with mantle and chimney free of cost.

The motion was carried, and the dividend recommended were declared.

THE GLASGOW SMOKE ABATEMENT EXHIBITION.

The Smoke Abatement Exhibition which is being held in Glasgow has proved so unqualified a success from the point of view of the attendance of the public, that the proposal was made that it should be kept open for a week longer than was intended. The Executive Committee considered the proposal last week, and resolved, in view of the difficulties in the way, to adhere to the original intention to close next Saturday. As an indication of the interest that has been taken in the Exhibition by the gas industry, we may say that Mr. Alexander Wilson, Gas Engineer and Manager of the Glasgow Corporation, has forwarded a list of names of about sixty gas managers who had visited it between the 16th and the 28th ult.

On Wednesday last, the first annual conference of the Smoke Abatement League of Great Britain was held in the City Chambers, Glasgow —Lord Provost M'Innes Shaw presiding.

The Lord Provost said that, through the initiative and action of the Corporation, an exhibition was running in the city for the purpose of showing to the public what could be done by the utilization of gas, electricity, and smokeless fuels in dwelling-houses and offices to prevent pollution of the atmosphere. The Corporation of Glasgow were manufacturers both of gas and electricity on a large scale; and it appeared to him it only required the rousing of a healthy public opinion and a keen civic conscience on the subject to create a largely increased demand for those smokeless means of heating and obtaining power.

Principal J. W. Graham (Manchester), the President of the League, explained its objects and what had been done since its formation at Sheffield a year ago. The idea, he said, was that the League should be a central body, consisting of branches in various localities. The branches were intended to do the local work of oversight and inspection; and the central body's function was to form agencies for doing parliamentary work and in general to guide the movement. Their efforts during the past year had been mainly to draw up a smoke charter, or sort of summary as to what was desirable. This was got up as a memorial, and signed by 19 large municipalities; and in June it was presented by a deputation to Mr. John Burns, who gave it a very favourable reception. Principal Graham then delivered a short address on "The Relative Proportion of Domestic Smoke to Factory Smoke." In Manchester, a number of analyses of air had been made. First of all, the ordinary soot from household fires was analyzed, then boiler soot, and, thirdly, the ordinary air of Manchester as revealed by the deposits left on the cotton wool of air purifiers in a hotel in the centre of the city. Roughly, without claiming perfect accuracy for the figures, results showed that factory and domestic smoke were about equally responsible for the pollution of the air of Manchester.

Sir Hugh Shaw Stewart, speaking of the effects of smoke and winter fogs upon buildings, pictures, and works of art generally, said it was not enough to do away with coal smoke. He was fortunate in getting the opinion of a very distinguished scientist, who said that the complete combustion of coal would obviate smoke but not the sulphuric acid which came from the combustion of the contained sulphur and which when brought down by rain had a destructive action on many kinds of stone. The use of coal gas obviated both effects; nearly all the sulphur being removed in the purification. Therefore they could overcome all the difficulty in cities by adopting gas or electricity.

Mr. A. H. Pettigrew (Glasgow) dealt with the deterioration of goods and merchandise through smoke and fogs. He ventured to say that on such an occasion of fog as last November, when for five days the fog fiend held the city in its grip, the loss to traders of all sections, from the small shopkeeper to the great wholesale and retail emporiums, amounted in the aggregate to £100,000. The fog attacked the warehouseman on three sides. Not only did it spoil his goods, but it cost him a small fortune for lighting, and it killed his trade for the time being by keeping customers away. If there was a class in the city whose profound gratitude the Corporation would gain if they successfully tackled the fog business, it would be the shopkeeping class. He would suggest that one way to do it, and the only way, was for each individual, either by consent or compulsion, to clean his own doorstep, so far as polluting the atmosphere was concerned.

Dr. Magnus MacLean (Glasgow Technical College) spoke of the advantages of warming rooms by electrical energy. He understood a proposal was shortly to come before the Corporation to give current for heating purposes at 1d. per unit. The proposal was not to put in new wiring or new meters, but to find the average current for a year or two, and charge the excess, if heating were used, at 1d. per unit.

Dr. A. K. Chalmers (Medical Officer of Health, Glasgow) dealt with the medical aspect of smoke pollution. He said the first point he would like to emphasize was that they were living constantly on the brink of a catastrophe, which only required certain weather conditions to precipitate. He gave illustrations from the experience of Glasgow. In 1874-5, after seven weeks of frost, the death-rate rose to 67 per 1000, half of which was due to lung disease. The death-rate for that year was 31. In 1895, after a period of prolonged frost and fog, the deaths in the first ten weeks of the year exceeded by no fewer than 1871 the number of deaths occurring in the corresponding period of 1892-4; and no period of life escaped. Under one year, the deaths rose from an average of 644 to 906—an increase of 41 per cent.; between 1 year and 60 years of age, the numbers rose from 1800 to 2800—an increase of 53 per cent.; and over 60 years of age, the deaths rose from 600 to over 1200—an increase of 103 per cent. The deaths from pulmonary disease, which averaged 1066, with a death-rate of 8 per 1000, rose to 2256, with a death-rate of 16. The winter of 1909 was remarkable for the recurrence of dense fog extending over several days, with an interval of a few weeks between. Here, again, the average annual rate of 18 rose to 25 during one week in November, and to 33 in December; and again the same disease predominated. It was greatest among young children and old people. Among infants, the numbers, which had been 217 in the three weeks ending Nov. 20, rose to 325 in the three weeks following that date; while among persons over 60, the deaths increased from 218 to 415. Wide fluctuations in weekly deaths were now more influenced by fog conditions than by zymotic diseases; and under conditions of prolonged cold and fog, the height to which a death-rate might rise was almost appalling and almost unlimited. Surely the epithet "disaster" was not misplaced when lives were sacrificed in this manner to what was at least contributory negligence on our part. The speaker referred to the difficulty gas engineers were under in providing gas when fog suddenly descended; and he advocated the establishment of a meteorological station in the Clyde Valley—as already existed in the Thames Valley—so as to foretell by a few hours the advent of conditions likely to produce dense fog.

Mr. Frank White (Bradford) briefly addressed the conference on the most recent legislation on the subject of smoke abatement. He mentioned that the Bradford Corporation had been successful quite recently in obtaining parliamentary powers for the prevention of the smoke nuisance; and these would come into force on Aug. 1 next year. Though there had been for some years past a steady diminution in the smoke emitted, it was found that more stringent powers were necessary. The small penalties imposed in the Police Court had no deterrent effect; and the Corporation sought and obtained the powers they now possessed and intended soon to put into operation.

Councillor W. B. Smith (Glasgow) spoke in support of "the desirability of having a uniform law throughout the United Kingdom and administrative means so that uniformity of inspection and administration may be secured."

There was a short discussion upon this, after which the proceedings were brought to a close by a vote of thanks to the Lord Provost and the speakers.

EDINBURGH AND LEITH GAS COMMISSIONERS.

Price of Gas Reduced—Scottish Office and Accounts.

A Meeting of the Edinburgh and Leith Gas Commissioners—the first since July—was held on Monday, the 26th ult. Lord Provost Brown, of Edinburgh, presided.

The Works Commissioners recommended that the prices to be charged for gas after the October-November survey should be: To ordinary meter consumers, 2s. 8d. per 1000 cubic feet; to outside consumers, 3s. 2d.; for gas-engines and trading purposes within the boundaries, 2s. 3d.; beyond the boundaries, 2s. 9d. In a report upon the subject by the Engineer (Mr. W. R. Herring), it was stated that the late Treasurer (Mr. John S. Gibb) and he estimated that the same quantity of gas would be sent out during the current year as was sold during the past financial year. In the latter case, 79,542,000 cubic feet more were sold than in the previous year. Provision had been made for reducing the prices of gas by 2d. per 1000 cubic feet. Last year the Commissioners made a special rate for gas used in gas-engines, but at the time deferred for further consideration the proposal to make the reduced rate apply to trading purposes generally. In order that the Commissioners might see to what extent it would affect their revenues, he had prepared data as to quantity, and assumed in the estimate that gas sold for gas-engines and for trade purposes other than lighting, heating, and cooking—that was to say, where gas was used in approximately equal quantities principally during daylight hours throughout the year—it could profitably be sold on the same basis as for gas-engine use. It was therefore suggested that this rate for the current period should be 2s. 3d. per 1000 cubic feet; such gas being supplied through a separate meter, which the consumer would pay for installing. Credit was taken for the quantity of gas sold per prepayment meter, at the lighting rate; but an additional item appeared on the revenue sheet, separately accounting for the 1s. 2d. per 1000 cubic feet charged for the extra cost of supply by this means. This was, however, subject to reduction by the sliding-scale already established. The estimates showed that, after making the reductions proposed, and after allowing for all oncost charges, including the contributions of £16,000 to the special reserve fund, there would remain on the year's working a surplus of £2084. One penny per 1000 cubic feet on the year's estimated consumption of 1,963,184,000 cubic feet represented a sum of £8180 per annum.

The estimates provide for an expenditure of £343,102, of which £97,226 is for coal, and £1909 for gas oil. The revenue is made up of £264,143 derived from the sale of gas, as compared with £281,360; £63,037 from residual products, as compared with £64,893; £5956 from maintenance and labour in connection with stair lighting; £4407 for the use of prepayment meters and other charges; £36 for meters hired for special purposes; and £6609 received as gas-stove rental and for the fitting of incandescent appliances.

The recommendation was adopted unanimously.

The Finance and Law Committee reported that they had remitted to the Convener, Judge Inches, and the Convener of the Works Committee, Judge Bryson, to deal with the matter referred to in the letter from the Scottish Office. It was explained that the Conveners had replied to the letter.

Lord Provost Brown said he signed the annual accounts on the assurance that they were made up absolutely in terms of the arrangement with the Scottish Office. It seemed to him this was not the case.

Mr. W. R. Herring said the Scottish Office were asking for information; and the Conveners had given the information wanted. The Office had been furnished with copies of the accounts; and they would mark the columns which they wished to be laid before the public. The whole statement was much too large for publication.

At the request of Lord Provost Brown the letter was read. It was as follows:

With reference to the abstract of accounts of the Edinburgh and Leith Corporations Gas Commissioners for the year 1909-10 forwarded by you on the 28th ult., I am directed by the Secretary for Scotland to make the following observations.

1.—The available borrowing powers of the Commissioners at the close of the account are put at £118,749, as against £109,716 at the close of the account for the preceding year. In what way is this increase explained?

2.—The contribution to sinking fund in respect of money borrowed—viz., 1 per cent.—appears to be calculated on the amount borrowed *less* sums previously paid off by means of the sinking fund, instead of, as usual, upon the full amount borrowed inclusive of such sums.

3.—It is observed that although £50,424 was carried to the credit of the sinking fund in 1909-10, only £3880 or thereby was applied from the fund

during the year in redeeming debt, and that at the close of the year the amount of the sinking fund invested or in bank reached the large total of £241,119. Is there any special advantage in accumulating the sinking fund in this way rather than in applying it to pay off debt? It is understood that the fund is not invested at a higher rate than is payable in respect of the annuity debt of the Commissioners, and that the Commissioners are entitled to redeem the annuities subject to the provisions of sections 48 and 49 of their Act of 1888.

4.—It is observed that the reserve fund authorized to be created by section 86 of the Act of 1888, and to be increased to a maximum amount of £150,000 by section 9 of the Order of 1902, is referred to in the accounts for 1909-10 as a "General Reserve Fund," while the supplementary provision directed to be made by section 7 of the Order of 1908 is credited to a special reserve fund. A considerable proportion (viz., about £7000, irrespective of interest accumulations) of the sum of £20,542 at the credit of the general reserve fund at the close of 1909-10 appears to have been set aside under the second proviso of section 9 of the 1902 Order, which enacts that the sums so set aside are to be applied "for the purpose of this section." Do the Commissioners consider that these sums (with accumulations) may only be applied in "meeting any deficit which may occur on the sale of the existing works on property of the Commissioners," or do they regard the term "purpose" in the last-mentioned proviso as including also the various purposes specified in section 86 (7) of the 1888 Act? Further, have the Commissioners yet ascertained or formed an estimate of the amount of the "deficit" referred to in section 9 of the 1902 Order?

5.—Can particulars be furnished of the item £48,487 (coal, lime, &c.) in the balance-sheet such as are given in the accounts of other local authorities?

6.—Does the item "Meters broken up . . . £973 12s. 8d." in the "Details of expenditure" mean that a sum of £973 12s. 8d. was expended during the year on new meters purchased to replace meters broken up? What was the cost of the broken-up meters as included in the item £64,228 in the capital account?

7.—Items amounting to £1110 15s. 8d. are charged in the revenue account in respect of depreciation on stoves, &c. This amount cannot be traced in the capital account, nor does it appear to be transferred to a depreciation fund. How is it disposed of?

8.—The abstract of accounts for 1909-10 only gives partial effect to the suggestion in the concludlng paragraph of the Scottish Office letter of Jan. 5, 1909, in respect that a table summarizing the statistical facts as to the quantity of gas made, &c., &c., in each year since the Commissioners were constituted is not appended thereto as requested. As such a table has been drawn up by the Commissioners, the Secretary for Scotland will be glad to be informed whether there is any objection to publishing it as an appendix to the annual abstract of accounts, and thus furnishing to gas consumers or other persons interested the same information as is supplied with respect to gas undertakings in the accounts of other public authorities."

The reply of the Conveners was as follows:

1.—The increase in the amount remaining to be borrowed as at May 15, 1910 (£9033), as compared with the previous year, arises from the facts (1) that mortgages which fell due in the course of the year were not renewed or replaced to the extent of £3073, and (2) that the amount borrowed on deposit receipt was reduced by the sum of £5960. Consequently, £9033 was added to the amount "remaining to be borrowed."

2.—The contribution to sinking fund in respect of money borrowed has always been calculated on the amount borrowed, less sums previously paid off by means of the sinking fund. This, in our view, is in conformity with section 93 of the 1888 Act, which prescribes that the amount to be set apart shall be "not less than 1 per cent. per annum on the amount for the time being borrowed under this Act."

3.—The Commissioners have, at every favourable opportunity, exercised the power to redeem annuities by agreement (section 47 of the 1888 Act), and during the current financial year a sum of £6836 has been applied in this way. The sinking fund moneys are invested at an average higher rate than is payable in respect of the annuity and mortgage debt, and, therefore, the sinking funds benefit to some extent. The question of redeeming debt more rapidly has been before the Commissioners of late, and they have decided to take action in this direction.

4.—The amounts set aside under authority of section 7 of the 1908 Order have been placed to a "Special Reserve Fund Account," because the section referred to does not limit the amount which may be accumulated for the special purposes named, and it was, therefore, thought desirable to keep the fund quite distinct. The Commissioners are of opinion that the amount standing from time to time at the credit of the general reserve fund is applicable for the various purposes specified in section 86 (7) of the 1888 Act, and section 9 of the 1902 Act. The Commissioners have taken steps to dispose of certain parts of the old works, but so far without result; and they have not yet formed any definite estimate of the "deficit" referred to in section 9 of the 1902 Act.

5.—The answer to question 5 is in the affirmative, but it is thought, for commercial reasons, not desirable to publish details.

6.—The sum charged in the accounts for "meters broken up" is the value (based upon current prices) of the meters actually destroyed during the year; and is in keeping with the practice followed for many years. The cost of the broken-up meters, included in the item £64,288, was approximately £973 12s. 8d.

7.—The amount charged to revenue account for depreciation on stoves, &c. is deducted from capital expenditure. During the year under review, the amount chargeable to capital account in respect of stoves, &c., was less than the amount written off as depreciation by the sum of £804 7s. 11d., and this amount is entered in the column headed "Deductions during year to May 15, 1910 (capital account)."

8.—There is no objection to publishing in the appendix to the accounts a table giving particulars as to gas made, &c. Statistical tables, giving a large number of details, were submitted to you (prints of which are enclosed herewith), and we shall be glad to have your comments thereon. If you consider a table or tables of a less elaborate character would meet your wishes, perhaps you would suggest headings for the same.

Heywood's Gas and Water Accounts.—The abstract of accounts of the borough of Heywood, prepared by Mr. J. Meadowcroft, the Borough Accountant, shows that the net profit of the Gas Department for the last financial year was £972, compared with £223 for the preceding period. The accounts of the Heywood and Middleton Water Board disclosed a deficiency of £10,820, compared with £11,027 for the previous year; Heywood's share of the loss being £5585.

Reduction in Price for Public Lighting at Edmonton.—At the last meeting of the Edmonton District Council, a letter was received from the Secretary of the Tottenham and Edmonton Gas Company (Mr. E. Topley) stating that, under a three years agreement which they had just entered into with the Tottenham District Council, the charge for public lighting in the district had been reduced 6d. per lamp per annum; and therefore the charge to the Edmonton Council would be lowered by a similar amount.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 22.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Apl. 1	5	Alliance & Dublin Ord. .	87—89	+3½	5 12 4
374,000	Stk.	July 14	4	Do. 4 p.c. Deb.	96—98	+1	4 1 8
200,000	5	May 12	7	Bombay, Ltd. . . .	6⅞—6⅞	..	5 5 8
40,000	5	,,	7	Do. New, £4 paid .	5—5½	..	5 6 8
50,000	10	Aug. 31	15	Bourne- } 10 p.c. .	28½—29½	..	5 1 8
311,810	10	,,	7	mouth Gas } B 7 p.c. .	16—16½	..	4 4 10
75,000	10	,,	6	and Water } Pref. 6 p.c.	14⅜—15¼	..	3 18 8
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	246—249	..	5 0 5
330,000	,,	,,	9⅜	Do. New . . .	184—186	..	5 2 2
50,000	,,	,,	5	Do. 5 p.c. Pref. .	—	..	—
206,250	,,	June 10	4	Do. 4 p.c. Deb. .	99—101	..	3 19 3
220,000	Stk.	Aug. 31	11	Brighton & Hove Orig.	215—218	..	5 0 11
246,320	,,	,,	8	Do. A Ord. Stk. .	155—158	..	5 1 3
460,000	20	Sept. 29	10⅝	British	44—45*	+⅛	4 12 4
109,000	Stk.	Aug. 12	6	Bromley, A 5 p.c. . .	117—119	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c. . .	88—90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c. . .	106—108	..	5 1 10
55,000	,,	June 29	3½	Do. 3½ p.c. Deb. .	85—87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97—99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3—4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref. .	5⅛—6⅛	..	—
50,000	50	May 3	6	Do. 6 p.c. 1st Mort.	56½—57½	+1½	5 16 6
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88—90	..	5 0 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord. .	109½—111½	..	4 9 8
1,513,280	Stk.	,,	5⅛	Commercial 4 p.c. Stk. .	105—108	..	4 16 3
560,000	,,	,,	5	Do. 3½ p.c. do. .	101—103	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	79—81	−1	3 14 1
800 000	Stk.	June 10	5	Continental Union, Ltd.	97—99	−1	5 1 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—139	..	5 0 9
492,270	Stk.	—	5½	Derby Con. Stk. . . .	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk. . . .	104—105	..	3 16 2
148,995	,,	Apl. 1	5	East Hull 5 p.c. Ord. .	56—98	..	5 2 0
486,090	10	July 14	12	European, Ltd. . . .	23¾—24	..	5 0 0
354,060	10	,,	12	Do. £7 10s. paid.	17½—18½	..	4 18 8
16,179,445	Stk.	Aug. 12	4⅝	Gas } 4 p.c. Ord. . .	106—107	+½	4 7 2
2,600,000	,,	,,	3⅛	light } 3½ p.c. max. .	87—89	..	3 18 8
4,062,235	,,	,,	4	and } 4 p.c. Con. Pref.	103—105	..	3 16 2
4,531,705	,,	June 29	3	Coke } 3 p.c. Con. Deb.	80—82	..	3 13 2
258,740	Stk.	Sept 15	5	Hastings & St. L. 3½ p.c.	92—94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	114—116	..	5 12 1
70,000	10	Apl. 29	11	Hongkong & China, Ltd.	17—17½	..	6 5 9
131,000	Stk.	Sept. 15	7⅛	Ilford A and C . . .	145—148	..	4 19 8
65,780	,,	,,	5⅛	Do. B	112—114	..	5 3 1
65,500	,,	June 29	4	Do. 4 p.c. Deb. . . .	98—100	..	4 0 0

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	May 12	9†	Imperial Continental .	187—189	+1	4 15 3
1,235,000	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.	93—95	..	3 13 8
200,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c. .	120—123	..	4 15 4
561,000	Stk.	,,	10	Liverpool United A. .	219—221	..	4 10 6
718,100	,,	,,	7	Do. B . .	162—164	+½	4 5 4
306,083	,,	June 29	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4⅛—4⅜	..	6 4 8
560,000	100	Oct. 1	5	Met. of } 5 p.c. Deb.	99—101*	+1⅛	4 19 0
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	99—101*	+⅛	4 9 1
541,920	20	May 27	3½	Monte Video, Ltd. . .	12⅜—13	..	5 7 8
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con.	102—103	..	4 5 0
529,435	Stk.	June 29	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
55,940	10	Aug. 31	7	North Middlesex 7 p.c.	15⅛—15⅜	..	4 16 7
300,000	Stk.	Apl. 29	8	Oriental, Ltd. . . .	138—140	..	5 14 4
60,000	5	Sept. 15	8	Ottoman, Ltd. . . .	6—6½	..	6 8 0
31,800	53	Aug. 31	13	Portsea Island A. . .	131—133	..	5 3 0
60,000	50	,,	13	Do. B. . .	124—126	..	5 3 2
100,000	50	,,	12	Do. C. . .	117—119	..	5 0 10
114,800	50	,,	10	Do. D and E.	99—101	..	4 19 0
398,490	5	Apl. 29	7	Primitiva Ord. . . .	7⅛—7⅜	..	4 13 4
796,980	5	June 29	5	Do. 5 p.c. Pref. .	5⅛—5⅜	..	4 13 0
488,900	100	June 1	4	Do. 4 p.c. Deb. .	97—99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb. .	97—99	..	4 0 10
250,000	10	Sept. 29	9	San Paulo, Ltd. . . .	15⅛—15⅝*	..	5 14 3
62,500	10	,,	6	Do. 6 p.c. Pref. .	11⅛—11⅝*	..	5 2 2
125,000	50	July 1	5	Do. 5 p.c. Deb. .	51—52	..	4 16 2
135,000	Stk.	Aug. 31	10	Sheffield A	229—231	..	4 6 7
209,984	,,	,,	10	Do. B	229—231	..	4 6 7
523,500	,,	,,	10	Do. C	229—231	..	4 6 7
70,000	10	May 27	7	South African	11—11½	..	6 1 9
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	121—123	..	4 8 10
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	80—82	..	3 13 2
209,820	Stk.	Aug. 31	8	South Shields Con. Stk.	155—157	+2½	5 1 11
605,000	Stk.	Aug. 12	5⅜	S'th Suburb'n Ord. 5 p.c.	120—122	..	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref. .	120—122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	121—123	..	4 1 4
502,310	Stk.	May 12	5	Southampton Ord. . .	110—112	..	4 9 3
120,000	Stk.	Aug. 12	7	Tottenham } A 5 p.c. .	141—143	..	4 17 11
483,940	,,	,,	5⅜	and } B 3½ p.c. .	112—114	..	4 16 6
149,470	,,	June 29	4	Edmonton } 4 p.c. Deb.	57—59	..	4 0 10
182,380	10	June 10	8	Tuscan, Ltd.	9—9⅜	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	97—99	..	5 1 0
236,476	Stk.	Aug. 31	5	Tynemouth, 5 p.c. max.	112—113	+½	4 8 6
255,636	Stk.	Aug. 31	6¾	Wands- } B 5½ p.c. .	139—141	..	4 15 9
85,766	,,	June 29	3	worth } 3p.c. Deb. Stk.	73—75	..	4 0 0

Prices marked * are "Ex div." † Next dividend will be at this rate.

LEICESTER GAS UNDERTAKING.

The New Manager.

At the Quarterly Meeting of the Leicester Town Council last Tuesday—the MAYOR (Mr. G. Chitham) presiding—it was reported that the accounts of the gas undertaking for the half year ending June 30 showed that the net profit, after paying interest on the capital, was £33,351. After deducting the sum of £7707, the half-yearly payment to the sinking fund, and in part repayment to the Public Works Loan Commissioners, a balance of £25,644 remained. For the six months there was a profit of £635 on the electricity works, after meeting interest and sinking fund charges.

Alderman SMITH, in moving the adoption of the two reports, said, referring to the gas-works, that it was the most successful half-year's working, so far as gross profits were concerned, since the undertaking was taken over by the Corporation. The gross profit, before deducting interest and sinking-fund payments, was £53,746, compared with £45,942 for the corresponding half of 1909. The net disposable balance in the past half-year's working, after providing for interest and sinking-fund charges, was £25,644; an increase over the corresponding period of 1909 of £7637. This increased profit was attributable to an increase in the receipts and a decrease in the expenditure. The cost of coal was £4081 less than in 1909; 3300 tons less being used owing to the increased quantity of gas made per ton, and to 9 million cubic feet of water gas being manufactured. Then £2376 less had been paid in carbonizing wages through the full working of the mechanical stokers, and the increased quantity of gas per ton of coal carbonized. The reserve fund stood at £26,032; and the Committee thought that this amount, having regard to the fact that the retort-house, buildings, gasholders, &c., were uninsured, was insufficient to meet the ordinary risks that were possible and probable in connection with gas manufacture. They therefore strongly recommended that a further £5000 be added to the reserve fund at the end of the current financial year. Since the Corporation took over the gas-works in 1878, after paying interest on capital, the profits had amounted to £1,027,656. Out of this sum, £247,501 had been paid to the sinking fund, £23,000 to the reserve fund, and £37,000 to the renewal fund. Including last half year, £745,030 had been contributed to the rates; and, in addition to this, the reduction in the price of gas was equivalent to £50,000 per annum. The success of the gas-works was largely due to the skilful management of the late Engineer (Mr. Alfred Colson) and the efficiency and loyalty of his chief assistants, the staff, and the workpeople generally. The Council would join the Committee, he was sure, in offering to the officers, the staff, and the workmen of all departments, this word of appreciation. As to the electricity works, there had been an increase of 15,800 units generated, but a decrease of £549 in revenue. The decrease in revenue was caused by the economy of the electric filament lamps which consumers were using. The net profit, after payment of sinking fund, was £635, against £907 last year. The balance now in hand was £2021. Since 1907, the total revenue had fallen from £32,882 to £28,832, a difference of £5000; but the net profit had only dropped £2600. There was a greater demand for electricity at present, and the prospect for the coming year was even better. As to the injunction restraining the Corporation from carrying on their electric wiring and fittings department, the Committee had decided not to appeal against it. The question of separating the Gas and Electric Light Departments' management was being considered by an expert; and pending the expression of the expert's opinion, the Council would not expect him to offer any opinion on the subject. When the expert's verdict was received, the Committee would go into the question.

Mr. SNOW asked if the time had not arrived when a reduction could be made in the price of gas.

Alderman SMITH, in reply, said it was easy to suggest a reduction in the price of gas; but to reduce the price 1d. per 1000 cubic feet would mean £8332 per annum. Again, when other corporations increased the price of gas owing to the increased cost of coal, Leicester kept its price the same. Next year they would have to pay at least £3000 extra for coal. The question could be considered better at the end of the financial year.

The reports were approved.

Alderman SMITH then dealt with the portion of the Gas and Electric Lighting Committee's report which related to the appointment of the new Manager of the gas-works, in succession to the late Mr. Colson. The Sub-Committee, he said, had unanimously decided on the appointment of Mr. Hubert Pooley, of Stafford, at a commencing salary of £800 a year. The Committee had made exhaustive inquiries, and had decided that, all things considered, Mr. Pooley was the best man they could find as their Gas Manager. He possessed exceptional advantages, which led them to believe he was the right man for Leicester. At Stafford he had carried out alterations under great difficulties. His relations with the Committee, the staff, and the workpeople at Stafford were of the most cordial character; and he took great interest in a profit-sharing scheme which affected the workpeople, and which he (Alderman Smith) thought might be introduced in Leicester.

Mr. Pooley's appointment was confirmed by 49 votes to 5.

Mr. POOLEY, on being invited into the Council Chamber and informed by the Mayor of his appointment, said it would be his earnest endeavour at all times to maintain the very high reputation which their undertaking had always held in his profession, and to follow in the steps of Mr. Colson.

New Issues of Gas and Water Capital.—It will be seen, from announcements which appear elsewhere, that Messrs. A. & W. Richards will resume their sales of gas and water stocks and shares at the Mart, Tokenhouse Yard, E.C., next Tuesday, when four important new issues of capital will be offered, by order of Directors—viz., Barnet District Gas and Water Company, £10,000; Aldershot Gas, Water, and District Lighting Company, £7000; Harrow and Stanmore Gas Company, £5000; and Great Yarmouth Water Company, £5000.

OUR STAND AT THE GLASGOW CORPORATION SMOKE ABATEMENT EXHIBITION.

Advertisement of the RICHMOND GAS STOVE & METER CO., LTD.

A "GREATER MANCHESTER" PROPOSAL REVIVED.

The proposal for an amalgamation of Manchester and Salford has been revived; and at the next meeting of the Salford Town Council an influentially signed petition will be presented in favour of the scheme. Twenty-two years ago a similar proposal was considered by a Joint Committee representative of the City and the Royal Borough; but it fell through because the conclusion was come to that there was no economic reason at the time for amalgamation, and that Salford would flourish more rapidly as a separate borough. The petitioners in favour of amalgamation now submit that the experience of the intervening years has shown that the anticipations of those who did not approve of the scheme have not been realized, and that, so far from improving, the economic condition of the borough has deteriorated; for, while the population and the rateable value of the borough have increased, its expenses have grown in greater proportion. The rise in rateable value in Salford, it is pointed out, has been mainly in small houses, largely inhabited by people whose business is in Manchester, while the development of the city has been in the direction of large works, offices, and warehouses, which yield a greater income in rates. It is urged that Manchester will always attract the large enterprises; while Salford will continue to supply residential accommodation for a growing proportion of the people employed in the city, without at the same time deriving any benefit from the rates imposed on the works, warehouses, and offices needed for these new enterprises. The petitioners will also submit that by amalgamation a great saving will be effected in the cost of administration and the working of such departments as the gas, electricity, and tramways. Five years ago, the Salford Town Council rejected an amalgamation proposal by 37 votes to 8.

BARRY GAS AND WATER UNDERTAKINGS.

The Past Year's Working.

At a recent Meeting of the Barry Gas and Water Committee, a report on results of the working for the year to March 31 was presented by Mr. T. E. Franklin, the Gas and Water Engineer and Manager.

Dealing first with the Gas Department, Mr. Franklin points out that there was a decrease in the amount of capital expended of £942. On the carbonizing plant, there was only £388 spent, as against £1160 the previous year; and while the capital expenditure on mains and gas-fires was slightly increased, there was a decrease on services, meters, stoves, and the fitting-up of houses. The Local Government Board have not only refused to allow the payment of the Council's own workmen when engaged on new work out of capital, but have, in a recent sanction for a loan, deducted the sum of £433, money so expended during the last few years. This amount has had to be taken from the reserve fund; and in future these payments will have to be provided out of revenue. The quantity of coke, breeze, and tar made for sale showed a decrease; while that of ammoniacal liquor exhibited considerable increase. Owing to the inefficiency of the station-meter, the total make of gas could only be estimated; and the figure was placed at 161,500,000 cubic feet. The quantity of gas sold showed an increase of 3,085,920 cubic feet as compared with 1908-9; being 156,735,670 cubic feet, against 153,649,750 cubic feet. The amount of unaccounted-for gas was 1,580,030 cubic feet; and that used on the works was reduced by over 600,000 feet. Coal cost £80 less than in the previous year—£9098, against £9898. This saving was due partly to the lower prices and partly to improved working, as, notwithstanding the increase in make of over 3,000,000 cubic feet, the quantity of coal carbonized was reduced from 15,707 tons to 15,230 tons—a saving of 477 tons. The make per ton of coal averaged 10,604 cubic feet—an increase of 535 feet per ton over that of 1909, and 1009 feet over that of 1908. The alterations to the hydraulic main, and the erection of a tar-tower were thus justified, as, though necessitating strict and constant attention, the anticipated increase of make was obtained. The expenditure out of revenue on the gas-works showed a decrease of £660; the amount spent being £1243. In this sum was included the cost of the retort renewals and repairs; conveyor, and gas-engine, &c., repairs; and the general upkeep of the works. A sum of £1482 was spent on the maintenance of the mains, meters, &c.—a decrease on the expenditure of the previous year of £69. In addition to the various work paid for out of revenue, a new set of exhausting plant, complete with accessories and foundations, was installed and provided for out of the reserve fund. The working of this plant has so far been very satisfactory. The total income for the year, as compared with that of the previous year, was augmented by £611. The increase in gas-rentals, &c., accounted for £555 of this sum; while that on residual products was only £56. The capital charges for the year were 1s. 1·35d. per 1000 cubic feet of gas sold. There was a substantial increase in both the gross and net profits over those of the year 1908-9; the gross profit being £14,846, and the net profit the record one of £6122. The respective increases were £2289 and £2203.

Referring to the figures in connection with the Water Department, Mr. Franklin says there was an increased expenditure of £63 on mains, meters, &c. The amount spent from revenue shows a total decrease of £191; being £807, against £998 during the previous year. The cost of the repairs and maintenance of works and plant at Biglis was reduced by £137, and as compared with 1907-8 by £218. In 1908, three patent forced draught furnaces were fitted to the Biglis boilers, at a cost of about £135; being paid for out of revenue. After their installation, the fuel costs were greatly reduced; a saving of £267 being effected during 1908-9, and of £352 during last year. There was also a saving in the repairing of mains, &c., of £54. The quantity of water pumped was very substantially reduced; the figures for the past three years being: 1907-8, 287,144,000 gallons pumped; consumption per head per day, 24 gallons. 1908-9, 257,235,000 gallons pumped; consumption per head

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per day, 21¾ gallons. 1909-10, 232,679,000 gallons pumped; consumption per head per day, 19¾ gallons. It will thus be seen that the more frequent inspections of fittings, washering of taps, and serving of notices, brought about a great reduction in the waste of water. A slight decrease of £49 occurred in water-rentals, &c. The gross profits (£5422) showed an increase of £316. Compared with 1908-9, the deficiency was lowered by £381, and with 1907-8 by over £1500. The deficiency in 1907-8 was £3911; in 1908-9, £2749; and in 1909-10, £2368.

The net profit on gas being £6122, and the deficit on water £2368, there was left a net surplus of £3754, compared with £1170 for the previous year.

The Committee, after going through the statements, unanimously expressed themselves as very pleased with the results. The Chairman (Mr. J. T. Hogg) said the results were the most satisfactory ever seen in connection with the Council. Not only were they the largest profits ever had from the department; but he did not think the works had ever attained such a state of efficiency as they were in at present.

ROAD-TARRING WORK IN GERMANY.

From "Engineering Record," New York.

The status of bituminous road work in Germany is shown in a report presented to the Association of Technical Officers of German Cities by Herr Sperber, Chief Engineer of Hamburg, and Herr Franze, City Engineer of Frankfort-on-the-Main. Letters of inquiry were sent to 89 cities; 43 replies were received concerning surface tarring, 11 concerning mixing methods of making bituminous roads, and 32 concerning the use of dust-preventives.

The experience in 43 German cities with the surface tarring of roads and footpaths was summarized substantially as follows: In most towns crude tar freed as much as possible from water, and obtained direct from the gas-works, is employed; only Munich having used in addition distilled tar and a mixture of pitch and tar. Berlin and Stettin have employed distilled tar, and Königsberg and Münster purified tar. Cologne has made experiments with apokonin (a proprietary compound of heavy coal-tar oils with hydrocarbons having a high boiling-point) as well as with tar. Stettin and Lübeck add some tar oil (up to 25 per cent.) to the tar, in order to dilute it. Dresden has used crude mineral oils, tar oils with and without admixture, and apokonin. The tar is generally heated up to 70° to 130° C., according to the quantity of water and ammonia previously liberated, so that it is applied to the surface on the average of about 90° to 100° C. Bielefeld has used tar at only 40° C. Cologne heats apokonin to 80° to 100°.

Cold tar has only been used experimentally at Brunswick on a small stretch of footpath. The roads were first thoroughly cleaned with hand-brooms or sweeping-machines (in Mayence with broom and jet-pipe). At Dantzic the surfacing was previously scarified. Then the tar was applied to the cleaned roadway with machine sprinkling carts, manual sprinkling carts, water-carts fitted with old sprinkling devices, or watering cans. In the case of footpaths, the tar was applied to the 2·4 to 4 inch coating of fine gravel, sand, or clinker after it had been in use for from five to six weeks by the traffic, and in part after being previously rolled afresh (Brunswick). At Wiesbaden all the playgrounds have been tarred, with very good results, since 1904.

Many towns have tarred only those old surfacings which were in good condition; and in nine towns the surfacings were previously repaired. One town (Stuttgart) will in the future tar only new surfacings, as do Aix-la-Chapelle and Leipzig. Dantzic has not tarred, but has rolled on the old roughened bed of road metal a layer of gravel 4 inches thick saturated with hot tar.

The period for finishing the road-metal surfacing up until the tarring varies greatly—from one to two years in Chemnitz to a few days in Heidelberg and Mayence. At Mannheim the tarring of surfacings rolled shortly before in the same year has not proved satisfactory. Supposing the road to have dried, most towns recommend tarring to be done from two to fifteen weeks after the finishing of the new road-metal surfacing.

As the most suitable time for tarring, the season from May to October is recommended, and by most engineers June, July, and August; dry weather being presupposed in all cases. When rain falls, the work has to be stopped until the road has dried again.

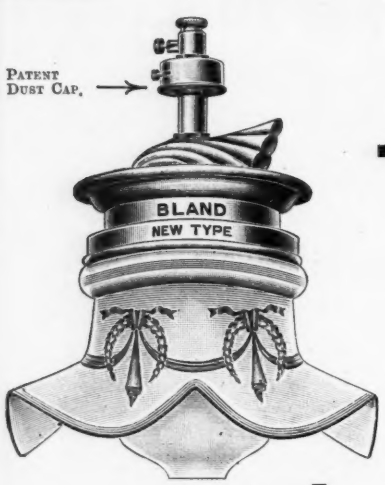
Thin coatings of sand are employed almost exclusively; coatings of stone dust or road dust being also used in addition in individual cases. This coating is only renewed at the places where tar is found to penetrate. Würzburg uses a thick coating of sand, Chemnitz fine granulite gravel and a double coating of tar. Darmstadt subsequently applies a little more sand. Individual towns apply the sand coating immediately after the tarring; others wait for from three to six hours up to one-and-a-half to two days.

The period from the finishing of the tarring of the road up to the opening for traffic varies greatly. Thirty towns open the road at once; at Brunswick and Crefeld, after three to ten hours; at Cologne at the earliest after two, and at the latest after eight hours; at Hagen, after four to six hours; at Berlin, after four hours, according to the weather. Fourteen towns open the road on the day after the tarring; three wait two days, and five wait three days when possible. Complaints about annoyance owing to odour or soiling have not been received in the great majority of towns; and no complaints were made as to injury to trees in roads.

In most towns there are no special specifications for the tar. Where they exist, they are confined to requirements as to the tar being as free from water as possible, obtained directly from the gas-works, and heated to at least from 50° to 70° in certain towns, and in others from 85° to 130°. In Mannheim there is the regulation that only tar as it comes from the gas-works may be employed, as the tests made with purified tar are not satisfactory. Cologne prescribes that the tar must be free from water—if possible, vertical-retort or water-gas tar—and must be a thin liquid of low specific gravity. The tar is not to be

The Burner of the Season.

The "Bland"—New Type.



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distilled; and the readily volatile oils must be retained in it. The anhydrous tar of the Wiesbaden Gas-Works contains 19 per cent. of oil and 78 per cent. of pitch.

The durability of the first tarring varies greatly; ranging according to the amount of the traffic in each instance—in most towns up to twelve months. Stettin has repeated the tarring only after four years. In roads having a considerable gradient, the tar surfacing lasts only until the approach of frost. Then it is torn up by horses' hoofs and the grinding of braked wheels, and particularly when the road-metal surfacing is hard, and but little tar penetrates. The tarring is not renewed, as a rule, in the year of application, but almost everywhere in the following year.

Tarring twice does not hold better than once at Mayence. On the other hand, double tarring, using a layer of fine gravel 0·8 inch thick, rolled by a steam-roller, has lasted longer than two years under medium traffic without repair at Leipzig. In most towns tarring is repeated only once a year. In three towns the tarring of footpaths has not suffered from wear after one year, except, owing to frost, where distilled tar has been employed.

Most towns have at first done the tarring with manual labour. The statements as to the size of the gangs and the performances with simple manual labour vary from four to eighteen men and from 350 to 710 square yards per ten hours. On an average, 108 square yards of tarred surface may be reckoned per man in one working day in the case of a gang of five men, when half the roadway is tarred at a time. If the thoroughfare can be stopped, this increases the average performance to 144 square yards. The average wage is 4s. per day per man.

In the case of horse-drawn tarring machines, the daily performance for one of the labourers, including driver and stoker, is on an average 1200 square yards. The statements as to the size of the gang belonging to a one-horse tarring sprinkling machine range from five men, including driver and stoker (machinist), up to thirteen men; generally there are five to six men. The daily performance amounts to 3600 to 7800 square yards with a 10 to 14 hour working day, or an average of 600 square yards per hour.

The opinions as to the advantage of rolling the tarred and sanded surfaces are various. Several towns are for rolling after sanding, and this generally with the steam-roller; on the other hand, the majority of towns consider subsequent rolling unnecessary. The cost of a square yard of the first coating amounts to ¾d. to 3d. for roadways with manual labour, and 1d. to 2d. per square yard with machines, and to ¾d. to 2½d. for footpaths. The consumption of tar for a square yard of roadway varies between 2·51 lbs. (Breslau) and 4·82 lbs. (Würzburg). On an average, the consumption of tar for a square yard of roadway amounts to 3·4 lbs., and the cost for this to about ½d. The cost of the second coating of tar is given by one town as equal to that of the first; and by another town as half as much. Leipzig has carried out double tarring 0·8 inch thick under a coating of spalls, a 22-ton steam-roller being made use of; and a square yard costs 1s. 1d. (without bed). Repairs have not in two years been necessary. This method forms the transition to tar macadam, respecting which particulars are given.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The report of the proceedings at the meeting of the Edinburgh and Leith Gas Commissioners last Monday (given on another page) affords a further illustration of the trouble, which often appears to be unnecessary, to which public bodies are subjected by Government officials, who are, to all intents and purposes, omnipotent within their own spheres. They have a way of getting public bodies to "work in harmony" with them which is not productive of a spirit of amiability. The valuation of the undertaking of the Gas Commissioners has again gone up. Two years ago it was £99,767; last year it was £106,177; and it has now been fixed by the local Assessors at £118,650. Of the total sum, £112,307 has been allocated to Edinburgh, £3599 to Leith, and £2744 to Midlothian. The undertaking is too prosperous; the rise this year being due to the surplus of nearly £11,000 which was realized upon last year's working. It will be observed that the surplus anticipated this year is only £2084.

There was a report before the Commissioners by Mr. W. R. Herring, as to the sales of coke during the past year, in which it was stated that the production of coke amounted to 121,231 tons, and that of this quantity they used in connection with steam-raising, locomotive, and other general purposes at the works, 16,070 tons, while 25,921 tons were used in the furnaces for heating the retorts. The balance of 79,241 tons, available for sale, was disposed of as follows: 32,493 tons sold to local customers; 31,265 tons shipped abroad; and the remainder, 15,483 tons, added to stock. The average price obtained was 9s. 2d. per ton, as compared with 9s. 10½d. in the preceding year. Messrs. Ramage and Ferguson, who were mentioned as complainers by Bailie Pennell, used the coke in a patent furnace for producing gas for heating ships' plates. The Commissioners used at Granton 25,920 tons of coke in their own furnaces for producing fuel gas; and they were therefore able to judge by daily experience as to its quality for such a purpose. It must, however, be borne in mind that the furnaces at Granton were designed to use the average quality of coke which it was known the Commissioners would produce; and while every care was taken in selecting the coal that would produce a good serviceable coke, it could not be denied that there were coals—much more expensive to purchase—that would produce a superior coke to their average quality. So far as could be determined from a sample of the coke which Messrs. Ramage and Ferguson were using, it was a quality that the Commissioners could not afford to produce in bulk, as they would not obtain any better price on the average for their annual output.

The proposal to introduce stoking machinery into the gas-works at Perth met with strong opposition from the Trades Council of the city. A deputation from the Council recently paid a visit to the gas-works; and in their report to the Council they stated emphatically, that in their opinion, the introduction of new machinery was neither necessary nor expedient. It had been conclusively proved to them that the

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present plant was not only equal to meet the requirements of the city at the present time, but was capable of producing more gas than was likely to be required by Perth in the next twenty years. The maximum make per day was 1,100,000 cubic feet; while the existing plant was capable of producing 2,000,000 cubic feet. The oldest part of the plant at present in use had only been in operation for nine years. The proposal was to shorten its life by five years; but it was maintained that, so long as the present plant was good for working purposes, and was gradually paying for itself, it should be allowed to remain until it was necessary to renew it. The machine which it was proposed to introduce had been on the market for only six years; and it would doubtless be subject to many improvements. Why not, the deputation asked, allow matters to remain as at present, and then they would have the benefit of those improvements later? Another reason for not proceeding with the scheme was that within the next few years revolutionary changes in the production of gas were anticipated. As to the argument that the introduction of machinery would lead to more humane conditions of labour, the deputies considered that this might be accomplished with the existing hand-worked appliances.

The Town Council on Thursday evening dealt with the subject. Councillor Wright, who was opposed to the proposal all through, considered that with the existing plant they had sufficient power to produce all the gas which would be required in Perth for a considerable number of years. He moved that the matter be delayed. Mr. Macpherson, the Convener of the Works Committee, moved that the scheme be adopted. He referred in sarcastic tones to the influence which the Trades Council had over the Town Council, in being able to induce them to toss aside a report by an expert and by their own Committee, who had specially inquired into the matter, in favour of a report by certain gentlemen who had no skilled advice whatever. It was wonderful, he thought, to find how strong outside influences could become when November was approaching. He maintained that the introduction of the machinery would mean a reduction of 1d. in the price of gas. Ex-Lord Provost Cuthbert, a former Convener of the Gas Committee, was of opinion that, in view of the heavy expenditure which had been incurred in connection with the gas-works, it was only by the introduction of labour-saving appliances that they could hope to reduce the price. He was not satisfied with the information submitted, however; and he moved that the matter be remitted back to the Committee, with the view of preparing a supplementary report showing the effect the improvements would have on the price of gas. This was carried, as against that proposed by Mr. Macpherson; but on a final vote, the motion of Mr. Wright, was adopted by twelve votes to nine.

The Banchory Gaslight Company, Limited, had a profit last year of £193, out of which dividend at the rate of 1s. 3d. per share has been paid. It was reported that a revaluation of the Company's assets had been made, with the result that the valuation had been reduced by £67. The price of gas was fixed at 6s. 9d. per 1000 cubic feet.

The Kelso Gas Company have reduced the price of gas from 3s. 4d. to 3s. 1½d. per 1000 cubic feet.

Stealing money from prepayment gas-meters has become so common an experience in Dundee that the prosecuting authority has taken exception to the system. At a meeting of the Gas Committee held this week it was reported that Mr. D. Dewar, the City Procurator-Fiscal, had sent a letter in which he pointed out that thefts from prepayment meters were becoming very common, and suggested that metal discs should be used instead of coins which he considered would do away with the temptation to steal. Mr. W. M. Burke, the Gas Treasurer, informed the Committee that he believed that such a system would not stop the thefts; that the discs would be stolen, and there would be a tendency to make resetters, because the discs would very likely be sold at such a rate as probably 12 for 6d. It was pointed out that in eight months 756 gas-meters had been broken open, and money stolen from them amounting to £150. Mr. Girrity said he observed that in one instance as much as 7s. 7d. was extracted from a meter; and he asked if the meters could not be more often cleared by the officials. Mr. Burke replied that the collections used to be made every three months, but that now they were made every six or seven weeks.

The incident with reference to the valuation of the gas and electricity undertakings belonging to the Dundee Corporation, which was referred to in my "Notes" on Sept. 20, has been amicably closed. On Monday, when the adjourned sitting of the Valuation Court was held, Mr. G. C. Brown, the Assessor, said he had much pleasure in stating that the valuations had been amicably settled. In the case of the gas, Mr. W. M. Burke, the Treasurer, had explained to him that he did not realize the importance of letting him have the figures early, and that the delay was putting him into a position of serious difficulty. He accepted Mr. Burke's explanation; and he was very glad to have the case amicably settled. The amount, in the case of the gas undertaking, had been fixed at £20,725. The claim by the Town Council was for £20,040. In the case of the electricity undertaking, the amount was fixed at £14,668, as against £12,733 asked by the Council. Bailie Johnston, who presided, expressed satisfaction that the little incident had been closed. One of the chief difficulties in the matter, it is explained, was in fixing the allowance to be made in respect of tenants' capital. This sum, in the Gas Department, in 1902-03, was fixed at £26,000, upon which the deduction as in lieu of interest was £975; in the following six years, the capital was fixed at £60,000, upon which the deduction was £3000; last year it was £100,000, with a deduction of £5000; and this year the capital has been fixed at £150,000, with a deduction of £7500. In the Electricity Department, the tenants' capital has been fixed at £66,000—a rise of £46,000.

There is a proposal on foot for the acquisition by the Corporation of Edinburgh of the site of the old gas-works in New Street, and the erection upon it of a new vegetable market for Edinburgh. The Markets Committee of the Town Council have had the subject before them, and have passed it on to the Town Council; while the Works Committee of the Gas Commission, on a preliminary consideration of the subject, have resolved to defer the matter till the Town Council have taken action. The area extends to 18,975 square yards.

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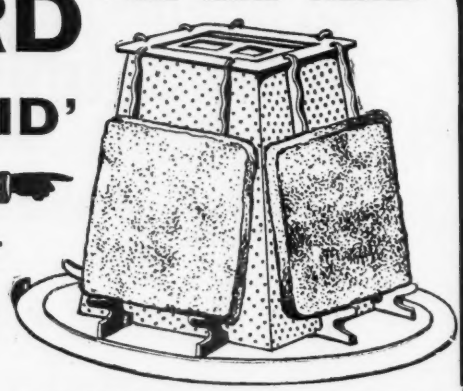

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 1.

Sulphate of Ammonia.

The market shows no sign of weakness at any point, and, though the end of a month has been reached, advancing prices continue to be paid for all available supplies. The further hardening of values has no doubt been occasioned by the appearance of some important new orders, and the closing quotations are: £12 12s. 6d. to £12 13s. 9d. per ton f.o.b. Hull, £12 13s. 9d. to £12 15s. per ton f.o.b. Liverpool, and £12 15s. to £12 16s. 3d. per ton f.o.b. Leith. In the forward position, there has been good inquiry, and business has been done for delivery up to the end of this year at prompt values; while for January-June, 1911, in equal monthly quantities, sales are reported at 2s. 6d. per ton less.

Nitrate of Soda.

In the early part of the week, the quotations for this article were raised to 9s. 6d. per cwt. for ordinary, and 9s. 9d. for refined quality, on spot; but buyers refused to follow the advance, and prices are again back at 9s. 4½d. and 9s. 7½d. per cwt. respectively.

LONDON, *Oct.* 3.

Tar Products.

The markets for tar products have been steady throughout the past week. Pitch still continues firm in England. There is no disposition on the part of makers to sell, as they feel confident that there is none too much pitch available, and that they will do better by waiting. On the Continent, buyers report that they are receiving offers from the Germans at reasonable terms for delivery over the first six months of next year. Benzol is steady, and there appears to be some improvement in the demand for this article. Makers advise that they have received offers at improved prices for next year's delivery; they having been offered 5½d. in buyers' drums east coast ports, but decline to quote anything under 6d. for January-June. Fifty-ninety per cent. benzol has improved in sympathy. Toluol is quiet. Buyers seem to be fairly well supplied; while makers are evidently quite easy, and are under no necessity to sell for the present. Solvent naphtha is steady, but orders are difficult to place. Heavy naphtha is quiet; and there are reports of rather low prices having been accepted for delivery all over next year. Creosote is quiet both in London and the North, but makers still look for better prices later on. Heavy oils are quiet, with not very much demand for them. Carbolic acid is steady; but the majority of makers decline to look at the prices offered. Naphthalene is quiet; but salts are in good demand. Tar is fetching good prices all round.

The average values during the week were: Tar, 18s. 9d. to 22s. 9d. *ex* works. Pitch, London, 37s. to 37s. 6d.; east coast, 36s. 6d. to 37s.; west coast, 38s. to 40s. Clyde ports, 35s. 6d. to 36s. 6d. Manchester, 36s. 6d. to 37s. 6d. Liverpool. Benzol, 90 per cent., casks included, London, 7d. to 7¼d.; North, 7d. to 7¼d.; 50-90 per cent., casks included, London, 7¾d. to 7⅞d.; North, 7¼d. to 7½d. Toluol, casks included, London, 9d. to 9½d.; North, 9d. Crude naphtha, in bulk, London, 3½d. to 4d.; North, 3⅝d. to 3¾d.; solvent naphtha, casks included, London, 1s. to 1s. 0¼d.; North, 11d. to 1s.; heavy naphtha, London, casks included, 11d. to 11½d.; North, 10⅜d. to 11d. Creosote, in bulk, London, 2⅜d. to 2½d.; North, 2d. to 2¼d. Heavy oils, in bulk, 2⅜d. to 2⅝d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 0½d.; west coast, 1s. Naphthalene, £4 10s. to £8 10s.; salts, 40s. bags included. Anthracene, "A" quality, 1½d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market for this article has been steady during the past week, and buyers appear somewhat inclined to purchase for far forward into next year at something approaching the present market price. Actual Beckton to-day is quoted at £12 3s. 9d. to £12 5s., and for forward delivery £12 6s. 3d. to £12 7s. 6d. London 25 per cent. is £12 2s. 6d.; Hull, £12 15s.; Liverpool, £12 15s.; Leith, £12 15s., and for forward £12 17s. 6d. Middlesbrough is £12 15s.

COAL TRADE REPORTS.

Northern Coal Trade.

The demand for coal appears to be a little weaker, and thus the prices seem to show a slight ease. In the steam coal trade, best Northumbrian steams are 9s. 9d. to 10s. per ton f.o.b., second-class steams are 8s. 9d., and steam smalls are from 5s. 6d. to 6s. 6d.—the latter class being rather more plentiful. The collieries are working fairly well, but lack of steamers at times causes a day or two's idleness at some pits. In the gas coal trade, the demand now begins to show a more steady increase; and the deliveries on the long contracts are growing to be very full, and to take up a larger part of the output of some of the collieries. Prices of Durham gas coal vary from 8s. 9d. to 9s. 9d. per ton f.o.b., according to quality, for the usual classes; while for "Wear" specials, 10s. 3d. is now the current price. There is rather less demand for coals for the Mediterranean—many of the users having bought gas coals over the next few months; and they ask for concessions in the price. But the general demand increases; and there is now a slight stiffening in the values of good gas coals for winter delivery. One large sale, however, has been allotted to Durham and Yorkshire coal; but the price has not transpired. Coke is steady, and gas coke more plentiful—the latter being about 13s. to 13s. 6d. per ton f.o.b.

Scotch Coal Trade.

There is a slight improvement in the demand, particularly the foreign demand; but the disturbances in the labour market are leading to indecision in purchases. The prices now quoted are: Ell, 8s. 9d. to 9s. 9d. per ton f.o.b. Glasgow; splint, 9s. 3d. to 9s. 6d.; and steam, 8s. 9d. to 9s. The returns as to shipments are incomplete. So far as

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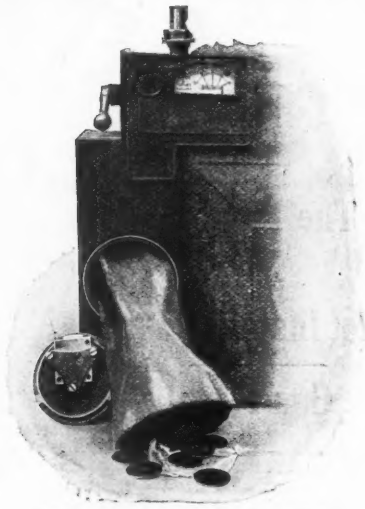
Showing Door of Box in Position.

Showing Coin Receptacle.


Showing Method of Emptying Coins.

FITTED TO THE POSITIVE PREPAYMENT METERS (WET OR DRY).

SAWER & PURVES,

MANCHESTER. Agent for Scotland: J. D. GIBSON, 2, Causeyside Street, Paisley. NOTTINGHAM.

they are made up, they show a total for the week of 327,183 tons—an increase of 3088 tons upon the previous week, but a decrease of 8845 tons upon the corresponding week of last year. For the year to date, the total shipments are given at 11,841,685 tons—an increase upon the corresponding period of 723,236 tons.

Compensation for Gas Poisoning.

At the Wrexham County Court last Friday, Margaret Jones, a domestic servant, claimed from Mr. John Settle, of the Royal Oak Hotel, Wrexham, 8s. per week compensation for injury sustained while in his employ. Applicant's case was that on awakening on the morning of the 16th of April there was a strong smell of gas in the room, and she had to put the bed clothes in her mouth and dress on the landing. She felt ill, and getting worse she decided to go home, and left on the 21st of April. She consulted Dr. Richard Evans, who instructed her to go home to bed. She had not been able to work since, and was still unwell. A plumber was sent for on the morning she complained of the gas, and he found that owing to the fusing of the electric wires there were leakages in the gas-pipe under the flooring boards in applicant's bedroom. Dr. Evans and Dr. Enoch Moss said they came to the conclusion that applicant had been poisoned by gas. For the defence, Dr. S. Edwards Jones said that he examined the girl on Aug. 22; and from his observations and the history of the case, he came to the conclusion that she suffered from anæmia and hysteria, and not from gas poisoning. Dr. Richard Williams said in his opinion the applicant had not suffered from gas poisoning. Defendant's housekeeper said the girl made no complaint to her before leaving; the mother being the first to say anything. The girl seemed very pale and weak when she was engaged, and had told witness that she left a former situation through ill-health. His Honour said he found that there had been an accident, and this led to an escape of gas, whereby the applicant suffered. He awarded her 7s. a week from the date of the accident to the 8th of August, and from that date until the 30th of October 3s. 6d. a week. He was of opinion that by the latter date she would have fully recovered.

Dorking Gas Company.—The half-yearly meeting of this Company was held last Tuesday—Mr. H. Young in the chair. The accounts presented for the six months ended the 30th of June showed a balance of £1869 available for distribution; and the Directors recommended the payment of dividends at the rate of 6 per cent. on the "A," "B," and "C" shares, and at the rate of 5 per cent. on the "D" shares. This would absorb £1337, and leave a balance of £532 to be carried forward. In moving the adoption of the report, the Chairman said the manufacturing results in the half year had been satisfactory. There had been a decrease in the quantity of gas sold, but this had been made up by economies in manufacture; so that the net result was about the same as in the corresponding half of last year. The report was adopted, and the dividends recommended were declared.

Fraudulent Use of Gas.

At the Tottenham Police Court last Thursday, Frederick Carter, of Junction Road, Tottenham, was summoned for fraudulently abstracting gas belonging to the Tottenham and Edmonton Gas Company. Mr. W. Windsor, who prosecuted on behalf of the Company, stated that at one time there were two meters in the rooms now used by the defendant—one being rented by the occupier of a front room, who required it for a gas-stove. This was subsequently disconnected when a lodger left, but the service-pipe remained; and the complaint was that the defendant procured gas from it, though he had a supply of his own. Up till March last, sums of 5s., 6s., and even 10s. had been collected from his prepayment meter; but subsequently the amounts dropped to 1s. 1d., 7d., and 5d. The decrease attracted attention, and an inspector visited the house, and found that the defendant had, by means of an india-rubber tube, connected the disused pipe with a gas-cooker in the front room. Upon being interviewed by the Engineer of the Gas Company (Mr. A. E. Broadberry), he said he thought the pipe was connected with the meter. It was estimated that if he had consumed gas at the same rate as last year he was indebted to the Company to the extent of 15s. 6d. Defendant was called, and stated that he was unaware that the gas was not registered. He explained that the reduction in the consumption since March was due to the fact that his wife had been going out to work, and that he had not been much at home. The Bench were of opinion that the connection could not have been made without guilty knowledge; and they imposed a fine of 10s. and costs.

Sulphur in Coventry Gas.—The Gas Engineer and Manager of the Coventry Corporation (Mr. Fletcher W. Stevenson) has been conducting experiments with the view of ascertaining whether there is any ground for certain complaints which have been made in regard to sulphur in the gas. He has lately reported the results to the Gas Committee, who have authorized him to obtain expert assistance.

Irlam Gas Supply.—The Urban District Council of Irlam, near Manchester, have under consideration the question of securing control of the lighting. At present the district gets its supply of gas from the Salford Corporation; and the District Council contemplate approaching the Gas Committee to ascertain on what terms they will "sell out." The development of Irlam, consequent upon the erection of extensive works on the banks of the Manchester Ship Canal, has led the District Council to make this new departure.

Suicide by Coal Gas.—Last Tuesday, a man named Boston, aged 54, a painter, residing in Lower Adelaide Street, Northampton, was found dead in bed; the room being full of gas. The bracket had been torn down, and a rubber tube attached to the pipe. At the inquest on Thursday, evidence was given to the effect that the deceased had been in trouble on account of his wife leaving him; but he had never threatened to commit suicide. The Jury returned a verdict of "Suicide by gas poisoning while temporarily insane."

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NOTE ADDRESSES.

Head Offices: EXETER.

London Offices: 18, ADAM STREET, ADELPHI, W.C.

SHOW-ROOMS: LONDON, 18, Adam Street, Adelphi, W.C.; DEVONPORT, 93, Fore Street.

Sale of Northwich Gas Company's Shares.—A number of shares in the Northwich Gas Company were offered for sale by auction on the 27th ult. Fifteen ordinary shares of £15 each, fully paid, sold for £32 each—establishing a record for this class of share in the Company. Ten preference shares of £10 each, fully paid, realized £11 8s. per share.

A Gas Supply Failure.—In consequence of the failure of the gas supply, Billingborough, in Lincolnshire, was thrown into darkness on Saturday night. Naturally, the inconvenience was principally felt by the tradesmen; and many business places had recourse to candles. It is reported that a similar failure was experienced a few weeks ago; and it is believed that serious leakage has occurred in the mains.

Sale of Coke at Coventry.—The question was raised at the last meeting of the Coventry City Council by Mr. Halliwell as to whether it was correct that the Gas Engineer and Manager (Mr. Fletcher W. Stevenson) prohibited dealers in coal and coke from selling coke at a lower price than 16s. per ton, while he himself was selling to factories in the city at less than this. The Chairman of the Gas Committee (Mr. Batchelor), in reply, said this was so. He explained that the fixed price was maintained so as to prevent undercutting; but he said some private buyers took as much as the largest dealers, or they possibly would import their coke.

Cost of the New Halifax Water-Works.—The Halifax Borough Treasurer (Mr. G. H. Fry) has issued a report on the abstract of accounts for the year ended March 31. Dealing with the water-works accounts, he states that the capital expenditure on the Walshaw Dean reservoirs at the close of the financial year was £339,930. Of this amount, only £289,199 had been authorized; and the balance was included in the Parliamentary Bill now being promoted by the Corporation. He adds that the minutes of the Council show that the delay in applying for this balance has been agreed to by the Local Government Board. The interest and sinking fund for the year with respect to the Walshaw Dean scheme was £15,333, or only £1442 less than the total deficit on the Water-Works Department for the year.

Sentence on the Bogus Gas Collector.—In the last number of the "JOURNAL," a case was reported in which a man named Atwell, aged 24, was charged before Mr. Cluer, at the Old Street Police Court, with committing a series of ingenious robberies from prepayment gas-meters in the districts of the three London Gas Companies. He was committed for trial, and was brought up before Mr. R. Wallace, K.C., at the County of London Sessions, last Tuesday. It was stated that there were forty cases against the prisoner in all parts of London, and that in one instance he left a serious escape of gas, which might have brought about an explosion. He had also undergone eighteen months' hard labour for a similar series of robberies, when he posed as a gas company's employee in order to get into the houses. Mr. Wallace sentenced the prisoner to 21 months' hard labour, and said that his age alone saved him from penal servitude.

Fatality at the Redheugh Gas-Works.—At the Gateshead Police Buildings last Friday, an inquiry was held into the circumstances attending the death of Ralph Oliver Bruce, aged 36, a coal tipper at the Redheugh works of the Newcastle-on-Tyne and Gateshead Gas Company. Thomas Jones, a locomotive driver in the service of the Company, said he found deceased lying beside the retort-house on the previous evening. He was injured about the chest, and died immediately afterwards. While witness had been bringing three empty waggons along from the retort-house, two of them left the line. It was then that witness found the deceased; and he thought he must have been struck by the waggons. The Jury returned a verdict of "Accidental death." Mr. T. Hardy, the Company's Chief Engineer, expressed sympathy with the relatives of the deceased.

Accident at the Exmouth Gas-Works.—As workmen at the Exmouth Gas-Works were about to resume after dinner last Tuesday, an alarm of fire was raised from the meter-house. It appears that three men were at work there finishing a connection of pipes with the new gasholder. A pipe leading to the smaller holder was opened up; and a bladder was placed in the pipe to cut off the gas while a connection was made. Whether a defect in the rubber bladder was the cause or not, is not known; but there was an escape of gas, which became ignited. The flames spread rapidly; and the meter-house was soon ablaze. The men rushed out; but all of them had received burns. The fire brigade was well assisted by the gas employees, about a score of whom were busily engaged covering the connecting pipes with tons of earth to keep the fire from the holder. The fire in the meter-house was got under, and then attention was turned to a pipe pit, where the gas was burning furiously—forced back from the holder. Earth was however, shovelled into the pit until the flame at the open pipe was extinguished.

Cirencester Gas Company, Limited.—At the annual general meeting of the Company last Wednesday, the Directors reported that the business continued to be progressive. The sale of gas in the year to the 30th of June was greater by upwards of 1,300,000 cubic feet than in the preceding year; while owing to improved working, and in some measure to the better quality of the coal received, the increase in the make of gas was effected with a saving of nearly 170 tons of coal carbonized. The net profit was £3104. Interest on the debentures and the usual interim dividend had been paid, and the Directors recommended a further dividend at the rates of £12, £6, and £8 8s. per cent. on the several classes of shares—making £11, £5 10s., and £7 14s. per cent. for the year. They also recommended that a further sum of £300 should be carried to the depreciation account. There continues to be a steady increase in the demand for prepayment meters; and the number in use has now reached 802. The works, plant, and mains of the Company have been kept in good order by the Manager (Mr. E. M. Beecham) entirely out of revenue. Expense has been incurred on new purifying plant; but the Directors said it had been completely justified, and the improved method of working had resulted in great economy in labour and saving of expense.

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THE INTENSE PILLAR FUEL introduced by us a Season or so ago which has proved a notable success. It is of special Shape and Texture and is rendered and maintained highly Incandescent with the smallest possible Gas Consumption.

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GAS-AIR ADJUSTER which ensures perfect combustion.

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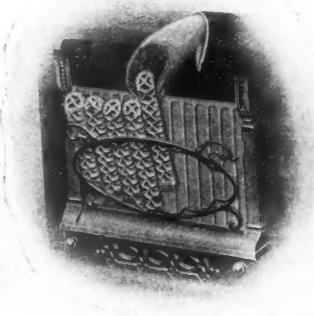

View showing method of Fuelling.

THE PARKINSON STOVE CO., LTD.

(INCORPORATING MAUGHAN'S PATENT GEYSER CO.),

BIRMINGHAM & LONDON.

The "Electrician" Printing Company have just published a diagram by Mr. R. Livingstonem (author of the "Mechanical Design and Construction of Commutators," and "Mechanical Design and Construction of Generators,") showing an easy method of calculating deflections in shafts and beams.

The Telephos Domestic and Street Lighting Company, Limited, was registered on the 27th ult., with a capital of £50,000 in 5s. shares. The object is to carry on the business of manufacturers of, and dealers in, "telephos" gas-switches, automatic gas lighting and extinguishing apparatus for street-lamps, &c. Among the first Directors are Sir James Heath, Bart., of Leamington, and Mr. A. E. Broadberry, of Tottenham.

Owing to a fault in a feeder at the Southport electricity works, on Sunday, the 25th ult., the electric light failed in one district of the town. It was not until about a quarter to nine that the defect was temporarily remedied and light restored. During the period of unexpected darkness, it was necessary to use candles at the various places of worship in the district; while the Infirmary was also lighted by the same means for about three hours.

We have received from Bullers, Limited, of Tipton and London, a pamphlet issued by them dealing with explosions of gas in electric-light boxes. In it are given short accounts of explosions which have taken place during the past seven years; and the advantages of the patent ventilated junction-box for underground cables, which the Company have brought out, in conjunction with the Managing Director (Mr. E. J. Chambers), for the prevention of these accidents, are set forth.

In a neat booklet bearing the title of "Congenial Warmth," the Cannon Iron Foundries, Limited, furnish particulars and prices of their radiators. Special attention may be directed to the "Torrid" radiator, shown on p. 10, which is a new production. It is fitted with luminous burners; and there is no flame-contact with cold surfaces, so that perfect combustion is secured. No flue is required for this radiator. The patent "Radio" pattern, which is also new, is fitted with an automatic gas-valve to maintain an even temperature and economize gas, and also with an automatic air-valve. Like the "Torrid," it can be placed in any position, as no flue is required. The other radiators shown are the Company's well-known types.

At a recent meeting of the Gas Committee of the Belfast Corporation, the tenders of the following firms for the supply of gas-meters were accepted: Messrs. Parkinson and W. & B. Cowan, Alder and Mackay, and Thomas Glover and Co.; for stoves and cookers, those of the following firms: Messrs. John Wright and Co., Arden Hill and Co., Fletcher, Russell, and Co., R. & A. Main, Wilsons and Mathiesons, Cannon Iron Foundries, and Richmond Gas Stove and Meter Company.

A domestic servant named Jennie M'Kay, a native of the North of Ireland, was found dead in her bedroom at the residence of her employer, Mr. Fred Grammer, of Cheadle Heath, near Manchester; and the evidence adduced at the inquest indicated that the girl had brought about her death through want of knowledge of how to manipulate a gas-tap. It was stated that the girl, who came from Dungiven, had, on taking up her duties, to be instructed as to the operation of gas-taps. The next day but one she was found dead in bed with the gas turned full on. The Coroner said it was clear from a letter found in the girl's possession that she was perfectly contented and happy in her situation. It was evident that, not being accustomed to gas-jets, she had, on retiring, first turned out the gas and then turned on the tap again. The Jury's verdict was "Accidental death."

The detailed report issued by the Directors of the Mannesmann Tube-Works, Düsseldorf, sets forth that in July a beginning was made with the manufacture of seamless gas-tubes by the Company's new process, and it is thought that in a few months this will be an important branch of the business. It is much cheaper and better than the welded process now generally employed, and confidence is expressed that it will eventually become an even more important trade than the seamless steam-tube business, which was begun about a dozen years ago. The turnover of the German works during the year covered by the report was 37,673,588 marks, against 35,292,637 marks the previous year; and that of the entire Mannesmann group 61,921,375 marks, against 57,044,677 marks. The present capital of the German Company is 22½ million marks, which is being increased to 30 million marks; and there are in addition loans to the value of 6½ million marks. The year's net profit was 4·7 million marks; 12½ per cent. dividend is again being paid; and the outlook is considered satisfactory.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

GAS MANAGER. Abercarn Gas Department. Applications by Sept. 22.
ASSISTANT-MANAGER (SOUTH AMERICA). No. 5294.
REPRESENTATIVE. "Gas Works," c/o Streets.
STOKER. Chertsey Gas Company.

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RETORT MOUTHPIECES AND RETORT-HOUSE GOVERNOR. No. 5293.

Meeting.

DANISH GAS COMPANY. London Agency. Oct. 25. 2.30 o'clock.

Stocks and Shares.

ALDERSHOT GAS AND WATER COMPANY (BY AUCTION). Oct. 11.
BARNET GAS AND WATER COMPANY (BY AUCTION). Oct. 11.
BOGNOR GASLIGHT COMPANY (BY AUCTION). Oct. 25.
DORKING WATER COMPANY (BY AUCTION). Oct. 18.
GRAYS AND TILBURY GAS COMPANY (BY AUCTION). Oct. 25.
GREAT YARMOUTH WATER COMPANY (BY AUCTION). Oct. 11.
HARROW AND STANMORE GAS COMPANY (BY AUCTION). Oct. 11.
SOUTHEND WATER COMPANY (BY AUCTION). Oct. 18.
TENDRING HUNDRED WATER COMPANY (BY AUCTION). Oct. 25.

TENDERS FOR

Coal.

LANCASTER GAS DEPARTMENT. Tenders by Oct. 13.

Retort-Bench, &c. (Dismantling and Rebuilding), Retorts, Alterations, &c.

BARNSLEY GAS COMPANY. Tenders by Oct. 11.

Retort-House Governors.

BARNSLEY GAS COMPANY. Tenders by Oct. 11.

Tar-Towers, &c.

BARNSLEY GAS COMPANY. Tenders by Oct. 11.

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Resists 4500° Fahr. Best for GAS-WORKS.
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Consumers in any form are invited to correspond with Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs.

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Address Correspondence and Inquiries to Oldbury, Worcs.
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The Reliance Lubricating Oil Company, 19 & 20, Water Lane, Tower St., London, E.C. Agents wanted.

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MATLOCK AND DISTRICT GAS COMPANY.

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long Experience in above, desires POSITION with a Provincial or Suburban Gas Concern having a growing Prepayment System.
Address No. 5295, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, for the Winter Months, a
good STOKER, used to Shovel Charging.
Apply to the Manager, Gas-Works, Chertsey.

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duce and push important article used in all Gas-Works. Must have Good Connections and be Good Salesman.
Please write, stating Qualifications, District, and References, to: "Gas-Works," care of Streets, 30, Cornhill, E.C.

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South American Gas-Works. Modern Practical Experience in Gas Manufacture and Distribution essential. Three Years' Engagement. Passage free. Salary, £500; free Residence. Single Man preferred.
Apply, by letter, stating Age, whether Married, Qualifications, previous Experience, and whether speaking Portuguese or Spanish, with *copies* only of Testimonials, to No. 5294, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

ABERCARN URBAN DISTRICT COUNCIL.
GAS-WORKS MANAGER.

THE above Council invite Applications
for the above Position.
The person appointed will be required to Devote his Whole Time to the duties of the Office, and to carry out such duties as shall from time to time be assigned to him.
Full Particulars may be obtained from the undersigned.
Applications must reach the undersigned on or before the 14th of October next.
Canvassing, either directly or indirectly, will be deemed a Disqualification.
Dated the 22nd day of September, 1910.
T. S. Edwards,
Clerk to Abercarn Urban District Council.
24, Stow Hill, Newport, Mon.

FOR SALE—Complete Gas-Making
PLANT, including New Gasholder and Steel Tank, 10,000 Cubic Feet capacity, ready for delivery, with Condensers, Scrubber, Purifiers, &c. Erected complete in England for £1200. Detailed Plan and Specification submitted.
TWO PURIFIERS, 12 ft. by 8 ft. by 5 ft. deep. Three Purifiers 5 ft. 6 in. square, complete with Four-Way Valves and Connections. Re-Erected cheap for immediate Sale.
GASHOLDERS, 16 ft., 24 ft., 26 ft., 30 ft., 42 ft., and 45 ft. diameter. Also 70,000 and 200,000 Cubic Feet capacity Gasholders. Cheap for immediate Sale. Re-Erected in either brick or new Steel Tanks. Full Particulars and Quotation submitted.
STORAGE TANK, 18 ft. long, 13 ft. 6 in. wide, 6 ft. deep, of ⅜-inch thick Boiler Plate. Also CAST-IRON TANKS. Inquiries Solicited.
Firth Blakeley, Sons, and Company, Limited, Thornhill, Dewsbury.

CORPORATION OF LANCASTER.
(Gas Department.)
TENDERS FOR GAS SLACK.

THE Gas Committee are prepared to
receive TENDERS for the Supply of Rough GAS SLACK, to be delivered on the Gas-Works Siding, Lancaster, in such Quantities, and at such times, as may be required during a period of Twelve Months, commencing delivery Jan. 1, 1911.
Sealed Tenders, endorsed "Gas Slack," giving full Particulars of the Slack offered, must be delivered to T. C. Hughes, Esq., Town Clerk, Lancaster, not later than Oct. 13 next.
Any further Information and Forms of Tender may be obtained on Application to the undersigned.
C. Armitage,
Manager.
Gas-Works, Lancaster.

FOR SALE—100 Tangyes Self-Sealing Inclined RETORT MOUTHPIECES, 16¼ in. by 24¼ in.; also 12-inch Milne RETORT-HOUSE GOVERNOR, nearly new.

Address No. 5293, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BARNSLEY GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the following:—

Contract No. 1.—For PULLING DOWN and DISMANTLING existing Bench, Settings, and Furnaces, and RE-BUILDING BENCH containing 5 Through Arches, 5 Settings of Eights (Horizontal), and 5 Through Furnaces on the Regenerator Principle; also ALTERATIONS to SUBWAYS, &c.

Contract No. 2.—New IRONWORK for 5 Through Settings of Eights, 21 in. by 15 in., including RETORT-HOUSE GOVERNORS, TAR TOWERS, and ALTERATIONS to existing Foul Mains, &c.

Specifications and Plans can be inspected at the Gas Office, Pontefract Road, Barnsley, upon payment of £1 in each case, which will, after the Directors have entered into a Contract upon the Tenders received, be returned to the Tenderer, provided he shall have sent in a *bond-fide* Tender and shall not have withdrawn the same.

Tenders to be addressed to the Chairman, endorsed "Tender No. 1" or "No. 2," and delivered at the Gas Office not later than Oct. 11 next.

The Directors do not bind themselves to accept the lowest or any Tender.

W. W. HUTCHINSON,
Secretary and Manager.

Gas Offices, Pontefract Road,
Barnsley, Sept. 28, 1910.

SOUTH BARRACAS (BUENOS AYRES) GAS AND COKE COMPANY, LIMITED.

NOTICE is Hereby Given that the Directors have declared an Interim Dividend at the rate of 4 per cent. per Annum for the Six Months ending June 30, 1910 (free of Income-Tax), payable on and after the 15th inst.

TRANSFER BOOKS WILL BE CLOSED from the 1st to 14th inst. inclusive.

By order,
W. UPTON,
Secretary.

1, East India Avenue,
Leadenhall Street, E.C.,
Oct. 1, 1910.

DANISH GAS COMPANY.

NOTICE is Hereby Given, that the FIFTY-SIXTH ANNUAL ORDINARY GENERAL MEETING of this Company will be held at the Offices of the Company's London Agency, Millbank House, Westminster, on Tuesday, the 25th day of October next, at 2.30 p.m., for the following purposes—viz:

1—To receive the Report of the Directors and the Accounts for the Year ended June 30, 1910.
2—To Declare a Dividend.
3—To elect Auditors for the ensuing Year.
4—To submit to the Shareholders resolutions authorizing the Directors to Purchase and Cancel Ordinary and Preference Shares of the Company as and when they may deem desirable.

By order of the Board,
H. G. WARREN,
London Agent.

London Agency: Millbank House,
Westminster, S.W., Sept. 29, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
HARROW AND STANMORE GAS COMPANY.

NEW ISSUE OF £00 £10 "C" SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 11, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY.

NEW ISSUE OF £3500 "C" CONSOLIDATED STOCK,
AND
£3500 FOUR PER CENT. CONSOLIDATED PREFERENCE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 11, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
BARNET DISTRICT GAS AND WATER COMPANY.

NEW ISSUE OF £10,000 "D" CAPITAL WATER STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 11, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
GREAT YARMOUTH WATER-WORKS COMPANY.

NEW ISSUE OF £4000 NEW ORDINARY STOCK,
AND
£1000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 11, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 1000 NEW ORDINARY FIVE PER CENT. MAXIMUM £10 SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 18, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Trustees of CHAS. KING, Esq., decd.
DORKING WATER COMPANY.

80 £10 FIVE PER CENT. "B" PREFERENCE SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 18, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, as above.

By order of the Directors of the
TENDRING HUNDRED WATER-WORKS COMPANY.

(Supplying Harwich, Parkeston, Dovercourt, Walton-on-Naze, Frinton-on-Sea, and adjacent places.)
NEW ISSUE OF 351 £10 "B" SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
GRAYS AND TILBURY GAS COMPANY.

NEW ISSUE OF 400 £10 "B" SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
BOGNOR GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £4000 ADDITIONAL ORDINARY CONSOLIDATED STOCK "A"
AND
£2000 FOUR-AND-A-HALF PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 25, at Two o'clock, in Lots.

Particulars of the AUCTIONEERS, 18, FINSBURY CIRCUS, E.C.

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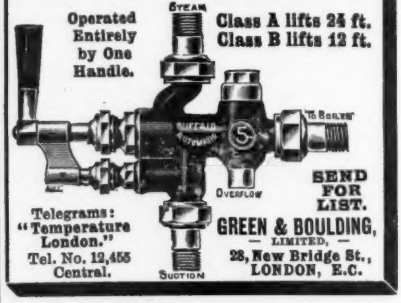

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Hamburg ,, (2nd Order)	14	310 ,,	42
Berlin, Tegel	27	526 ,,	81
Rome	20	350 Tons	60
Paris, Genevilliers	20	272 ,,	60
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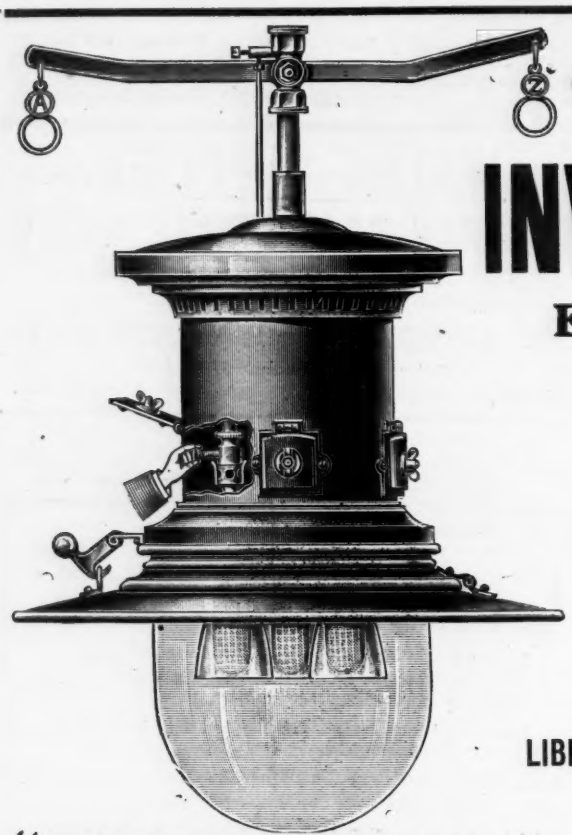

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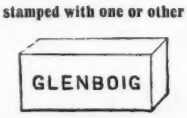

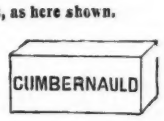

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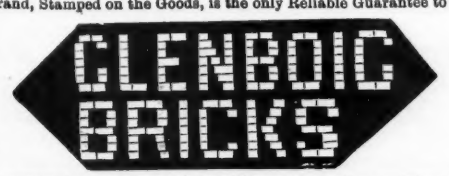

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The GLENBOIG BRICKS, BLOCKS, AND RETORTS combine, in the highest degree, the qualities of not melting, and not splitting, when subjected to the highest heats and most sudden changes of temperature, and are, in consequence, found to be economical, even in districts where the local bricks can be had at half the price.

Undernoted we give a Table of Analysis and Physical Characteristics of a sample of Glenboig Fire-Clay by J. T. Norman, London; and, in submitting a report from a responsible and reliable public analyst, we would here draw attention to the unreliable character of some recently published analyses where a manufacturer selects not only his own samples, but also those of his competitor, and has them treated by a private analyst. SUCH STATEMENTS ARE ALTOGETHER UNTRUSTWORTHY.

ANALYSIS OF GLENBOIG FIRE-CLAY.

By JOHN T. NORMAN, Esq., F.C.S., &c., The City Central Laboratory, LONDON.

THE GLENBOIG UNION FIRE-CLAY CO., LTD., GLENBOIG, SCOTLAND.

28, Leadenhall Street,
London, E.C., September 21st, 1909.

Dear Sirs,

I have completed the investigation of the samples of Clay received from you on the 10th inst., and now beg to report the results.

CHEMICAL ANALYSIS.

	Raw.	Fired.
Silica, free	3·03	3·49
Silica, combined	43·20	49·77
Alumina	36·55	42·10
Ferric oxide	1·80	2·08
Titanic oxide	1·30	1·50
Lime	trace	trace
Magnesia	trace	trace
Alkaline oxides	trace	trace
Sulphates as trioxides	0·92	1·06
Loss on Ignition	13·20	—
	100·00	100·00

PHYSICAL RESULTS.

Density	2·65
Volume weight	1·90
Porosity	15·4 %
Linear shrinkage at 100° C.	3·70%
" " " 1050° C.	4·76%
" " Total	8·46%
Volume shrinkage at 100° C.	10·7 %
" " " 1050° C.	12·6 %
" " Total	23·3 %
Plasticity	20·0 %
Fire Stability	1850° C. equiv. 3362° F. (SEGER CONE 36.) (New Scale CONE 38.)

(Signed) J. T. NORMAN.

This Clay is remarkable for its high percentage of Alumina and for the almost complete absence of ingredients tending to lower the refractory properties; its fire stability is extremely high. For some years past I have been urging clients who are working the Clays of the Coal Measures to search for such a material, but you are the first to discover a supply. The possession of this Clay places you in a unique position amongst the manufacturers of refractory goods throughout the world, and I have no doubt will, if duly exploited, enable you to drive out of the market the large quantities of foreign fire-bricks which are being poured into this country for use in the construction of bye-product ovens and for other purposes.—I am, yours faithfully,

JOHN T. NORMAN.

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Are the exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, Wigan, and of the Manton Steam and House Coal Collieries, Worksop, Notts, and supply the well-known Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, House and Steam Coals, &c.

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Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone: No. 200.

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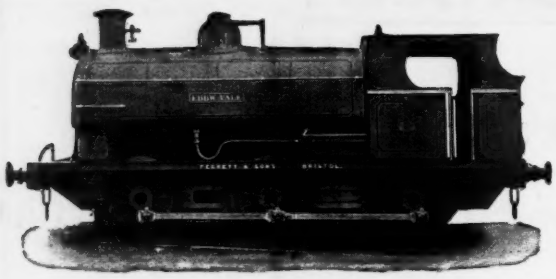

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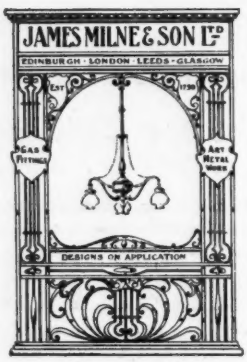
For the **LIGHTING SEASON,** 1910-1911.



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THE CENTENARY PETROL GAS TURBINE GENERATOR.

NOTE—It does not matter how irregularly the number of Lights in use vary, this is the only Petrol-Air Gas Generator which maintains under all conditions of tests an unvarying quality of Gas.

TESTIMONIAL.

ROYAL SCOTTISH NURSING INSTITUTION,
69, QUEEN STREET, EDINBURGH, 24*th February*, 1909.

DEAR SIRS,

I have much pleasure in testifying to the brilliance of the Lights, purity of the atmosphere of the rooms, agreeableness to the eyes, with entire absence of odour, together with the fullness of health, enjoyed by myself and inmates of St. Cyr. Ceres, during my residence for four months during Winter, while the house was lit night and morning (and small lights during night) by Petrol-Air Gas produced at the Village Gas-Works by a Centenary Turbine Gas Generator. The brilliance and comfort with the lights could not be excelled.

I am, yours truly,

(Signed) Nurse B. BROWNIE.

N.B.—St. Cyr House has 50 Burners for Lighting, besides points for Cooking and Ironing.

THE CENTENARY GAS COMPANY (Dept. M.)

109, HOPE STREET, GLASGOW. 11, QUEEN VICTORIA STREET, LONDON.

NON-EXPLOSIVE and ECONOMICAL.

Welsbach
LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

BRITISH MADE.

Fig. 623. Three-Light.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**
Case contains . .	*80*	*18*	*18*	*12*

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Wired Globes, extra each	**2/-**	**2/-**	**2/9**	**3/6**
Parabolic Reflector, extra "	**3/6**	**6/-**	**7/6**	Not made

Welsbach Mantles, **4½d.** each, or **4s. 3d.** per dozen, subject as usual.

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

THE WELSBACH INCANDESCENT GAS LIGHT CO., LTD.,
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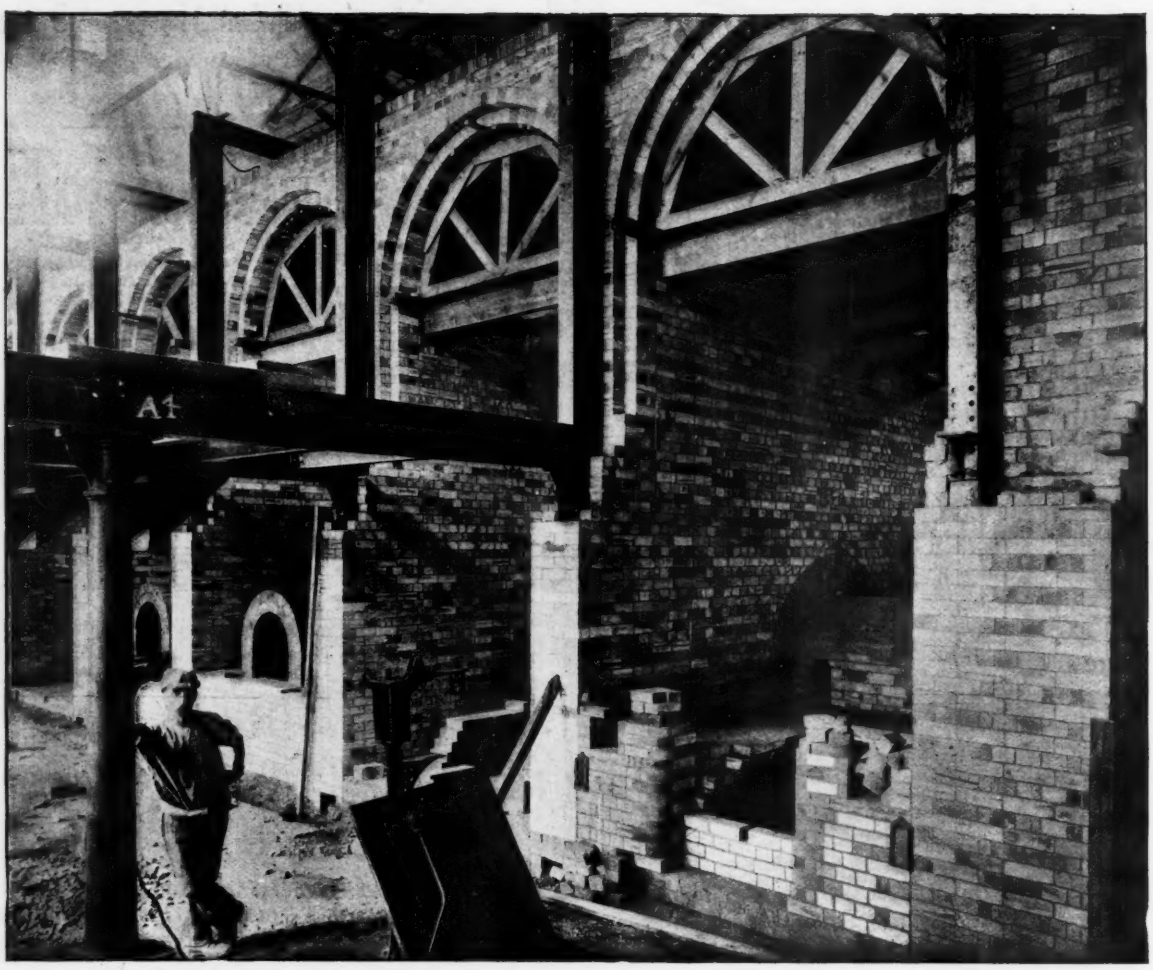

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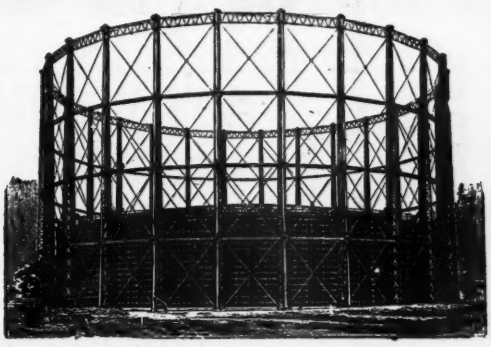

Triple Lift Gasholder, 212 ft. 6 in. diameter by 45 feet Lifts, erected at Garston, Liverpool.

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CONSTRUCTIONAL STEEL WORK.

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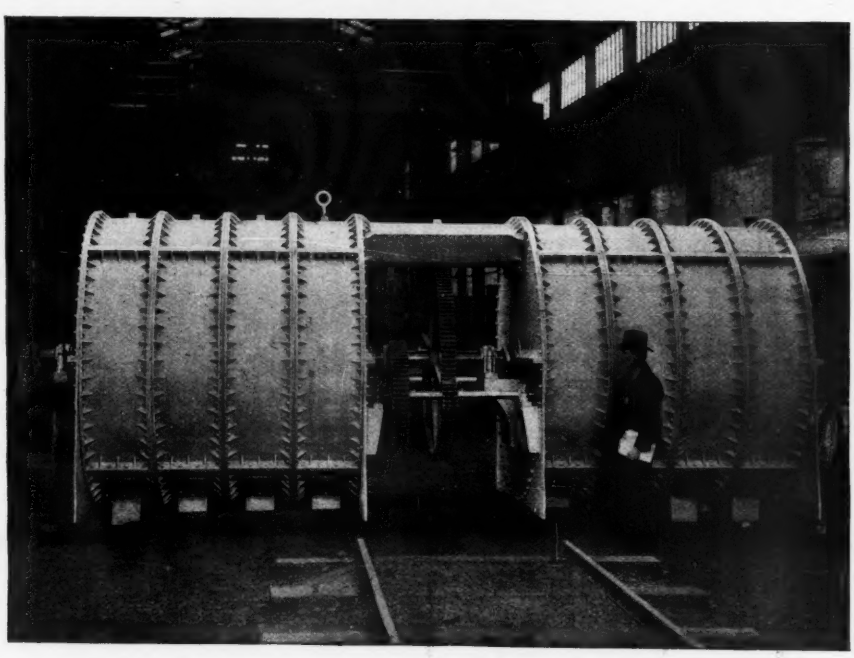

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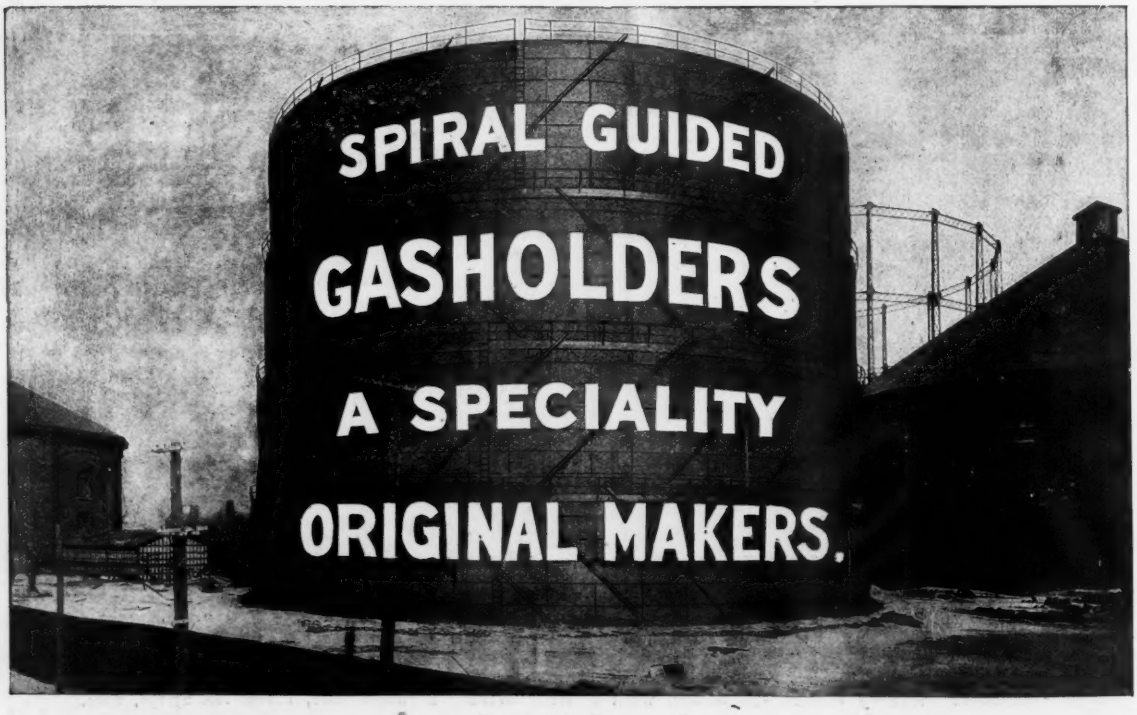

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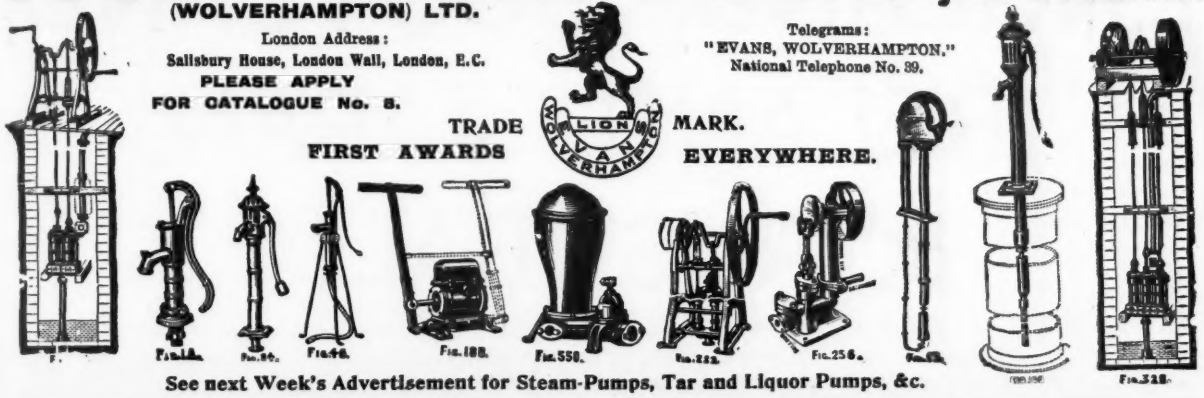

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